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The Current Agricultural Revolution

A. N. DUCKHAM

WE ARE IN THE MIDST OF REVOLUTION in the agriculture of temperate countries. This is most marked in the advanced industrial countries, and in advanced agricultural countries like Denmark and New Zealand which have strong economic links with industrial countries. Thus, in the past 20 years in the United Kingdom, we have increased our net agricultural output by 60 per cent without increasing either the area we farm or the manpower on the land. In other words, each man and each acre is producing on average one and a half times as much as 20 years ago. This is a remarkable technological advancement. But it is not confined to this country. This same kind of story can be found in North America, Scandinavia and the Netherlands.

Though the pattern of economic and social change is not the same in the agricultures of these various countries, the nature of the technical changes are broadly similar. In each case there has been, firstly, a great increase in the dependence on industrial inputs such as tractors, machinery, fertilizers, herbicides, etc., and secondly, a change in the role of geographical controls, or perhaps one should say bio-geographical controls. The following analysis of the nature of these technical changes and their geographical implications is confined, for the sake of simplicity, to the United Kingdom.

AGRICULTURE AND INDUSTRY

The rate of change on a British University farm

The kind, variety and rapidity of contemporary change can be illustrated by a comparison of what we are doing today on the University of Reading's Sonning Farm with what we were doing there 20 or 25 years ago—twenty-five years is a very short period in the history of agriculture. In describing these changes I am using technical terms which may be unfamiliar; their unfamiliarity will, however, serve my purpose which is to stress what is *new*, that is to say, something which we did not possess or do in 1935.

May is generally our busiest month. In May 1958 we were trying to finish our spring work before we started our first harvest of the year —grass silage, i.e. green-cut grass that is preserved by the more or less controlled fermentation of its own substance; for the lactic and

➤ Professor Duckham is head of the Department of Agriculture at the University of Reading. His article is based on a lecture delivered at the Annual Conference of the Geographical Association on 31st December 1958.

other acids produced by naturally occurring bacteria create acid conditions which effectively preserve green material. We harvest it by a *new* tractor-drawn hammer-mill armed with flails (forage harvester), which cuts and chops the grass (to say nothing of an occasional flint or forgotten ploughshare) and forces it into *new* hydraulically operated tipping trailers. In 1935 we did not make grass silage.

Thanks to the cereal breeders, we were in May 1958 giving our *new* higher yielding varieties of cereals their final dose of nitrogen fertilizer at high rates which would have been unthinkable before the second war. To cut out hand-thinning and hand-hoeing, we were using a *new* down-the-row thinner on sugar beet, one field of which got a shot of *new* manganese as soon as we diagnosed a deficiency of this element.

Thanks to the Aberystwyth plant breeders and the fertilizer manufacturers, we were in mid-May grazing some *new* Italian rye-grass (S.22) for the *third time* this spring—something we should not have thought possible 25 years ago.

Our *new* sprinkler irrigation system was at work on our *new* 2–4 year leys made up of *new* strains and varieties of grasses and clovers. As we finished grazing, we moved the *new* electric fence forward so that the *new* rotary tiller (used instead of a plough) could prepare, almost in one operation, a seed bed for marrow-stem kale. In southeast England this fodder crop has, since 1935, largely replaced swedes, turnips and mangolds as a succulent winter cattle feed.

The *new* weed spraying machine was hard at work applying the *new* herbicides which the scientist and the chemical engineer have given us. A week or so later we applied a *new* systemic insecticide to check the aphis (virus yellows vector) build-up on our beet. These *new* weed-killers and insecticides are highly selective, special purpose chemicals. So it is not surprising that in the course of a year we use nearly a dozen different formulations, depending on the crop we are spraying and on the weeds or pest growing in or on it.

All this—indeed all our field and carting work—is done by tractor; the last horse left Sonning Farm about 5 years ago.

In the cowshed the story is also *new* and complicated. The medicine chest has been almost completely restocked. We now have *new* magnesium sulphate for hypo-magnesaemia; *new* calcium boro-gluconate for milk-fever; *new* glucose (injected) and glycerin (oral) for ketosis (acetonaemia); *new* sulpha drugs for minor infections such as foul in the foot; *new* penicillin, streptomycin and chloramphenicol for summer mastitis cases.

If a cow does not come on heat within 60 days of calving, we use *new* stilboestrol (a sex hormone) to promote oestrus, and thus permit service. If, on the other hand, a cow does not hold to her third service, the vet. may use *new* luteinizing hormone to help retention of the fertilized ovum (or young embryo), and so improve the effective calving rate. As in human medicine, non-infectious metabolic stress

diseases are on the increase and infectious diseases on the decrease, at least in cattle. Thus, both abortion and tuberculosis were big problems pre-war, but *new* Strain 19 vaccine now controls contagious abortion, and the official eradication scheme keeps bovine tuberculosis at bay.

We keep only one bull because it is cheaper to run him with the heifers than to use *new* artificial insemination. The cows are all inseminated artificially. We killed off our senior bull (at age 12 years) in November, 1956, after building up a stock-pile of *new* deep-freeze semen from which we have now in the herd three heifers conceived since his death.

To save wages, which have risen and are rising more rapidly than other costs, we have gone over to *new* parlour milking, and replaced steam by *new* caustic soda for sterilizing our *new* stainless steel milking machines, the pulsation rates and ratios of which are controlled by a *new* electronic device. By not replacing a man due to retire on the management side, the saving thus made would justify replacing our *new*, but obsolescent, sugar-beet harvester, and improving our *new* grain drying equipment, which helps us to handle a large acreage of cereals in a wet harvest with our new combine harvester.

In the face of this increasing technical complexity, we have since 1956 at Sonning Farm *simplified* the farming system somewhat by giving up both poultry keeping, which we now concentrate at our Lane End Farm, and potatoes, which we grow with cereals, beef and pigs at our Upperwood Farm. It may be possible to simplify Sonning Farm still more by reducing the hay and kale acreage in favour of grass silage, and by giving up pigs. In other words, we are trying to offset increasing technical *complexity* and rising labour costs by reducing the number of enterprises, and so simplifying the farming system. At the same time we have increased the flexibility of our rotations and, where necessary, have reduced our husbandry standards to save labour.

What we have done, and are doing, at Sonning is by no means exceptional. There are many thousands of commercial farmers doing or using all or many of these *new* things in advanced intensive (and extensive) areas, and so adding to the *potential* technical complexity and capital needs of their farming. These trends are forcing them, in fact, to simplify and specialize.

Current research

This technical revolution is by no means over. Indeed, it may have only just begun. Agriculture is now a very dynamic, flexible industry, and is likely in 20 years time to differ from today as much as 1958 differs from 1938. To emphasize this point let us look at some of the new things that will hit the farmer in the next ten years. Let us do this by looking at current applied research in agriculture proper, i.e. at the final link in the chain between science and engineering at one

end and farm practice at the other, by examining some of the current projects in the Department of Agriculture at the University of Reading. With one exception the projects mentioned here are concerned with modifying bio-geographical controls.

During the growing season southeast England has a marked *moisture deficiency*. In the mid-summer months when light-energy and temperature respectively reach their seasonal maxima, we are losing too much water by evapo-transpiration. Consciously or unconsciously we have built our cropping policies and summer livestock feeding programme round this mid-summer moisture deficiency. However, experiments with grass at Sonning have given striking responses to added water supported by added nitrogen fertilizer. This has led us on to detailed studies of water-cum-fertilizer relations in grass strains and species; between the grass and legume and the cereal in undersown leys; and between weeds and cereals in corn crops, and so on. Such research in practical plant physiology at Rothamsted, Hurley, Reading and other centres in many parts of the world, will doubtless make a big impact on grass and crop husbandry over the next ten years.

Another seasonal bio-geographical factor is *day-length*. This, as we all know, strongly influences the flowering dates of most agricultural plants. Thus, barley requires a long day before it will start to form ears, i.e. yield grain. But day-length also influences the reproductive cycles in animals. Using electric light to lengthen the day of laying fowls influences their sex hormones and, if they are fed well, increases their output. We have also found at Reading that, in the fowl, sexual maturity is stimulated by the act of increasing, and postponed by decreasing, day-length; we are using this finding to delay the onset of lay because, though we want to *breed* for early sexual maturity, we want to *manage* to delay it until the birds are well-grown enough to stand the strain of egg production.

In the sheep, we know that oestrus, and hence the breeding season in the autumn, is brought on by the action of decreasing day-length on the glands producing certain sex hormones. So we are trying to see if we can make sheep breed twice (instead of once) a year, either by hormone treatment or by giving them *shortening days* in the spring when, of course, the days are normally *lengthening*.

In cattle and sheep for meat we are also studying the effect of simulated seasonal changes in diet on growth and development.

Labour is scarce and dear, and equipment is expensive; their effective joint use is vital. Hence we are studying the seasonal pattern of farm work to see if we can eliminate the peaks of man work and machine work, and so reduce the need to carry men and machines which are under-employed at slack times of the year, such as mid-winter.

Automation—a non-biogeographical factor—is in the air. The growing dearth of men, the rise of wages, the need to get rid of dull jobs and the future demand for remote-controlled machines to apply gamma

radiation for, say, weed control—all these point to automation. In conjunction with the Electrical Research Association and various manufacturers, we have built and demonstrated the prototype of an unmanned, electronically-controlled automotive machine tool. This, when unmanned, will be able to do routine or dangerous (e.g. radio-active) jobs. With the help of the Agricultural Research Council we are at work on a complementary tractor which will need less headland space and be more precise for steerage hoeing or, say, herbicide placement than the current trade models.

I hope that what I have said so far will have amply demonstrated my first theme, viz. that the current and forthcoming agricultural revolution is mainly based on the urban products of science and engineering. The chief exception is the work of the plant and animal breeders, who improve the genetic make-up of the crops and stock we use. But even the exploitation of such genetic improvement largely depends, at least in this country, on increased inputs of industrial products. This development is examined in some detail in *The Fabric of Farming*.[1]

Industrial background to technical change

To get this very important point in perspective, we need only remind ourselves that up to the middle of the nineteenth century "agriculture was still living on the skin of the earth and on what plants and animals could extract from that skin and from the air and rain". Since then farming has ceased to be a closed biological system. Two types of "mineral"—inorganic fertilizers and iron and other metals—have, with the aid of two fossil fuels—coal and oil—and of the industrial fixation of atmospheric nitrogen, changed the face of farming in all advanced countries. These great improvements help man to feed and support the biological forces of nature and to make his motive power and energy sources largely independent of the soil. Each horse needs three acres or more of land; each tractor releases at least twice that area of land for the growing of marketable food or fibre. As tractors spread across the world, less and less of the world's farming acreage is tied in producing motive power for agriculture.

As long as agriculture was wholly dependent on sun, air, water and top soil, the warp and woof of the fabric of farming were of the same kind and colour of thread. Now, however, it is, in advanced countries, only the warp that comes from unaided nature. The woof comes, in one form or another, from the towns. And, as a result, agricultural output has vastly increased and could be increased very much more.

But if we congratulate ourselves on the efficiency of our farming, on the high quality of our diets, and on the great rise in agricultural production, we must, in the same breath, admit our vulnerability. For if, by reason of some catastrophe, we suddenly lost present-day

'mineral' and industrial inputs of oil fuel, fertilizers and technical chemicals, and could not call on electricity, transport and other public services, food output in Britain and other advanced countries might well be halved.

THE CHANGING ROLE OF GEOGRAPHICAL CONTROLS

What influence has all this had on geographical controls? I have space to do no more than list what seem to me to be the main points worth your consideration.

Differential effect on highland and lowland farming types

The Ministry of Agriculture map of farming types (published by the Ordnance Survey in 1944) is still much as it was 20 years ago. But the rate of change within the various types of farming areas has been lowest where geographical controls are most severe. With the help of the National Agricultural Advisory Service, the Department of Agriculture at the University of Leeds, and the Department of Geography at the University of Sheffield, I made a study of the types of farming in the Sheffield district, which offers a useful cross-section of the United Kingdom.[2] The most rapid changes have been in the lowland arable areas (Type VI to IX)* east of the line Wakefield, Sheffield, Chesterfield and running across to Retford and Gainsborough. Change is less marked in the grassland dairy area (Type III) to the west of Sheffield, though milk has tended to creep up the hills. It is least marked in the mountain sheep and upland livestock raising areas (Types I and II) round Bakewell, Buxton, Kinder Scout and Dunford Bridge; here altitude, rough terrain and high rainfall limit the effective growing season, the crops that can be grown and also the practicability of mechanization. The last is very important, for mechanization does more than save labour; it enables the farmer to do things more quickly at the time they should be done, and it permits him to use fertilizers and technical chemicals with greater ease and effect.

Effect within lowland farming systems

The shortage of manpower, the growth of mechanization, and the higher inputs of fertilizers and technical chemicals have had, and are having, substantial effect on lowland systems. High-labour fodder-root crops (like swedes and turnips) are less commonly grown, partly because herbicides enable us to do part of the weeding by chemicals in corn crops, instead of by hand or tractor hoe in root crops. Fertilizers are reducing the need for dung and other organic matter as a source of plant nutrients, though organic matter (humus) *may* still be needed to maintain crumb structure of the soil. The greater power and speed

* The Type numbers are those of J. Gibbons, J. S. Hopkins and L. M. Waud. Chapter 13, Agriculture, in *Sheffield and its Region*, British Association, Sheffield, 1956.

of the tractor has allowed arable cropping, or at least ley farming, on some heavy clay lands that were 20 years ago under perennial grass, e.g. the Keuper Marl in north Nottinghamshire, the Blue Lias clays and the heavy Essex clays.

In brief, the combined effect of fertilizers, technical chemicals and mechanization has been to give the lowland farmer much greater flexibility in rotations and in cropping and stocking systems; the rising cost of labour has persuaded him to exploit this flexibility in favour of those enterprises which give the greatest output per £100 spent on wages. He is no longer so tied to the traditional patterns of farming. The map of lowland type of farming is now, and is likely to remain, in a state of flux for the rest of this century, particularly if irrigation goes ahead rapidly.

Effect on climatological controls

The control of day-length in poultry production, the possibility of controlling its influence in sheep breeding, and the possible use, as Peterson, Cooper and Vose suggest,[3] of late or non-flowering pasture-grass species, are examples of escape from that most relentless and forecastable of all climatic factors, the annual march of day-length.

The growth of combine harvesting and grain drying, of the barn drying of hay and of grass silage making, are examples of partial escape from the least forecastable climatic factor, viz. day to day moisture conditions, especially in areas with a high mean summer rainfall (see L. P. Smith's *Farming Weather* for a useful discussion on some of these points[4]). The advent of irrigation in the south and east of the United Kingdom is an attempt to escape from the serious seasonal moisture deficit we can expect in six or more years out of ten south and east of the line from Hull, Hereford and Weymouth.

The use of winter-hardy grasses, such as some strains of Italian rye-grass and of the kales, may provide a partial escape from the tyranny of the threshold temperature of 42° or 43° F. Do we incidentally place too much reliance on the number of days above this temperature as a measure of the length of the growing season? Do we overvalue "accumulated temperatures" as a climatic indication of production potential? Would not, as L. P. Smith once suggested to me, "potential evapo-transpiration" be at least as useful an indicator measurement?

Growing interest in bio-geographical controls

This tendency to escape from what one might call the classical bio-geographical or ecological controls, has heightened agricultural interest in such controls. In particular, we are greatly interested in local and micro-climatic factors such as the conditions most favourable or unfavourable to such troubles as the virus-bearing potato-aphis, potato-blight, liver-fluke, frost pockets, crop moisture needs, soil water

levels, and so on. We are no longer content to be fenced in by geographical controls, but are studying their habits in detail so that we can plan successful escape from their dominance.

On page 45 of his book, *The Principles of General Ecology*, Woodbury states that:—

"The general trend in evolution has been in the direction of more and more isolation of the body from environment, and better and better control of exchange with it [the environment]. This has been correlated with a great increase in complexity of organization".[5]

Apply this natural biological law to "agricultural progress" and you have the situation in a nutshell. The application of the biological sciences in the form of better genes and of industrial inputs of machines, fertilizers, technical chemicals, has made farming more independent of environment. We are now better able to overcome, control or evade those particular parts of the environment which impede efficient and economic food production.

In other words, as we rely more on machines, fertilizers, technical chemicals and other non-farm inputs, we become less dependent on local climatic and bio-geographical factors—both as raw materials for agriculture (e.g. soil, rainfall) and as boundaries of the industry of farming, especially in the lowlands. But, at the same time, our organization tends to become more complex *unless* we consciously simplify and specialize.

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[1] A. N. Duckham, *The Fabric of Farming*, London, 1958.
[2] See A. N. Duckham, *op. cit.*, chap. v and folder at end.
[3] M. L. Peterson, J. P. Cooper and P. B. Vose, "Non-flowering strains of herbage grasses", *Nature*, vol. 181, 1st March 1958, pp. 591–4.
[4] L. P. Smith, *Farming Weather*, London, 1958.
[5] A. M. Woodbury, *The Principles of General Ecology*, New York, 1954.

Problems of Land-Use Mapping in the Tropics

An Example from Ceylon

R. WIKKRAMATILEKE

SYSTEMS AND PATTERNS OF TROPICAL AGRICULTURE are highly peculiar to local environments. They often display a primitive dependence on varied physical circumstances and a like degree of attachment to diverse traditions and social dictates. In view of these complexities, mapping techniques and land-use classifications need careful adjustment to the conditions in the field and the evaluation of survey results requires an intimate appreciation of the area mapped. No successful universally applicable mapping procedure and code has yet been devised. Even in the case of the World Land Use Survey,[1] initiated in January 1950, a most carefully prepared legend by a group of professional geographers presented considerable difficulties when applied to Ceylon.

For example, according to this code, though provision was made for a distinction between shifting cultivation as undertaken by migratory peoples and land rotation practised by sedentary populations, the identification and mapping of these two categories in the field was not only difficult but also of doubtful value. *Chena*, or land rotation, in Ceylon's Dry Zone is today practised both by settlers from established villages and by a growing number of itinerants, but with little or no visibly different impact on the landscape. On the other hand the long-term geographic, economic and social consequences of these two forms of land rotation may be distinctive. But then, although chena in some areas has many of the attributes of *zande* or migratory shifting cultivation in Africa, it does not necessarily follow that the overall implications of chena practised by itinerants over the years should parallel those of zande.

Most mapping techniques and schedules have been evolved in and applied to occidental mid-latitude areas that have an orderliness of land-use patterns, defined agricultural cycles and a high degree of agricultural stability. Annual changes in such mid-latitude agricultural landscapes tend to occur within the design of a permanent framework and long-term shifts maintain recognizable patterns. Mapping techniques have undoubtedly to be adjusted as changes occur,

➤ Dr. Wikkramatileke is a lecturer in geography in the University of Malaya, Singapore.
Acknowledgment is made to Mr. J. Ngai, draughtsman in the Department of Geography, University of Malaya, for preparing the drawings for Figs. 1 and 2.

but such interruptions and disturbances often are of a nature that permit initial mapping and re-survey.

In the tropics, on the other hand, agricultural stability and relative permanence of land-use patterns can be associated more often than not only with the growing of irrigated rice and plantation crops. Subsidiary crop production in general is ephemeral both in respect of areal distributions and crop types. Crop patterns and agricultural cycles are largely conditioned by rainfall which, in most tropical areas, is a highly variable factor. Much of the tropical agricultural landscape is therefore one which presents very little of the long-term evolutionary progression evident in the occidental mid-latitudes.

Small-scale tropical field operations, hand executed and employing a negligible outlay of capital, are subject to sudden deviation during a given crop sequence on meeting physical obstacles, or even on the whims of the cultivator. The very mobility of residence and the frequent transfer of cropping to areas not recently cultivated constitute elements of change seldom encountered in occidental mid-latitudes. Furthermore, short intervals are sufficient for the natural obliteration of the imprint of the cultivator. The traditional use of long-term fallowing, in which exuberant wild plant regrowth is an important factor in the process of land regeneration, and the paucity of wheeled traffic prevent the accumulation of an orderly and easily accessible landscape. Field mapping in the tropics is also handicapped to a greater extent than in the occidental mid-latitudes by the lack of suitable base maps and other technical facilities for expeditious work.

In this paper an attempt is made to set out some of the issues and problems of land-use mapping in the tropics with examples derived from a sample study in Ceylon. The area selected is in the south-central lowlands of the island and covers approximately 60 sq. miles immediately to the west of the Walawe ganga (Fig. 1).

THE PHYSICAL AND CULTURAL BACKGROUND

Figure 1 provides a representative example of the rural landscape in Ceylon's Dry Zone, illustrating the elements of early land-use patterns and associated practices as well as the more recent developments in agricultural settlement. The traditional agricultural complex is a three-fold one made up of rice cultivation on irrigated paddy land, complemented by 'dry' cropping of annuals on chenas* in the surrounding forests, and by the growing of perennial tree crops together with annuals on the domestic gardens around the permanent dwellings located close to the irrigated tracts.[2] This complex is indicative of adjustments made by small isolated communities living in an environment in which the critical factor is the seasonal rainfall régime with the certainty of a dry season during which the natural water supply is

* The term chena is also applied as a noun to the forest clearings themselves.

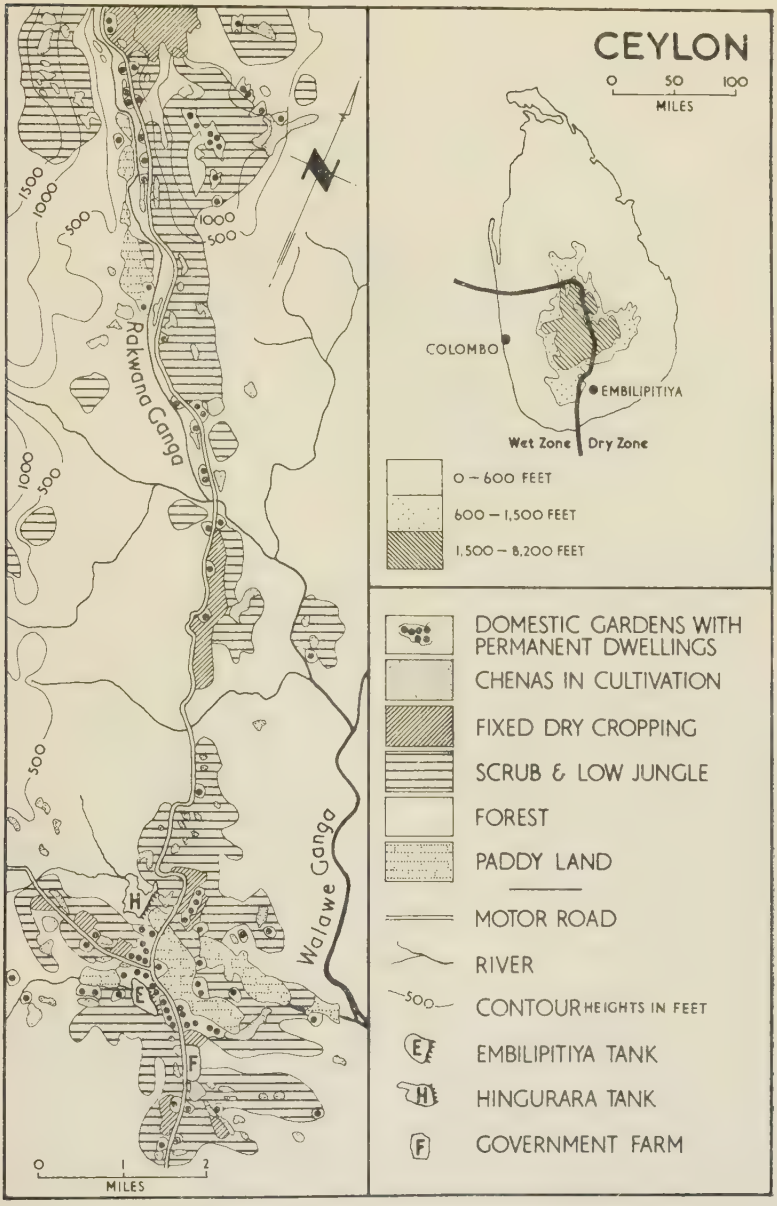

Fig. 1.—Land use, Embilipitiya area.

insufficient for most crop growth (see Table I). The balance attempted between irrigated cultivation and 'dry' cropping reflects the acute recognition of a markedly seasonal variation in soil moisture.

Table I

AVERAGE ANNUAL RAINFALL AT EMBILIPITIYA (in inches)

J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
4·6	3·0	6·7	6·9	4·5	1·6	2·1	1·4	3·0	8·7	9·9	8·2	60·6

The imprint of the traditional agricultural complex is still dominant within the area (Fig. 1). Much of the land is as yet under forest or scrub jungle. The greater part of the cultivated area is concentrated around two localities. The first of these cores is around Embilipitiya in the gently undulating country to the south, and the second is around Pallebadde in the hilly country to the north of the area. It is fundamental that, in the context of the traditional three-fold complex, permanent land occupance is in and adjacent to the irrigated paddy lands. Even at the present time, it is around the irrigated tracts that the bulk of the population in the area, numbering about 1800 persons, are concentrated in permanent settlements. Unlike the paddy lands, the chenas are extremely changeable components of the landscape. These forest clearings are customarily cultivated by peasants who live in the permanent settlements and spend much of their time on irrigated rice cultivation. A chena is usually abandoned after the initial crop season.

Contemporary developments have initiated not only modifications in traditional land-use patterns but changes in the functional aspects of agriculture as well. The high increases in population in recent years have not been supported by an extension of the irrigated areas. This has led to an increasing dependence on 'dry' cropping, and consequently a greater proportion of the forested land is now being utilized each year for this purpose. The significance of this dependence is indicated by the emergence on the landscape of a new element in the agricultural complex, namely, 'fixed dry' crop units and permanent settlement sites away from the core areas of settlement near the irrigated tracts. This development, primarily a ribbon orientation alongside roads, is now tending to mask traditional land-use patterns by linking the hitherto nucleated agricultural settlements.

Plate 1.—Aerial view of lowland bordered by slightly higher ground at top and bottom margins of photograph. The fine dark lines which give the field mosaic pattern in the lowland could easily be interpreted by one unfamiliar with this type of landscape as low hedges and not as the 12- to 18-inch high earthen ridges on a paddy field. Similarly, the circular patches, which are earthen threshing floors, could perhaps be mistaken for light gun emplacements, as indeed they were on occasions during the second war. The speckled plots, e.g., near X, are newly tilled units—an indication of the beginnings of a planting season. The broader dark bands, tree-lined in parts, along the periphery of the lowland, and also within it, are irrigation channels.

Plate 2.—Aerial view northeast of permanent dwellings (bottom right of photograph) and domestic gardens adjacent to road on northern fringes of Embilipitiya. The complex detail shown, e.g., jungle (1), scrub (2), vegetables (3), live fence (4), bare ground (5), bananas (6) and coconut (7), indicates the difficulties encountered in mapping land use in areas of close settlement. Part of the irrigation channel from Hingurara tank, which serves the paddy land in the upper sections of the photograph, is seen at X.

Plate 3.—Aerial view northward over the road junction at Embilipitiya, showing the core area of close settlement. The northern margin of the gangoda in the sector west of the road running north is apparently about the line X—X while to the east of the road the limit is set by the paddy fields. The southern margin merges into the scrub areas (Y).

Increasing population pressure, on the irrigated lands in particular, in conjunction with the breaking down of isolation through improvements in communication, has also resulted in substantial alteration of the indigenous subsistence and basically self-contained economy. 'Dry' cropping, either chena or 'fixed', has become for many the basis of an insecure money economy as well, and some have to depend on it exclusively for a living. These contemporary trends, as will be shown later in the paper, create the problem common to many tropical areas of reconciling and indicating two economic systems of land use, the dividing line between which is not easily definable, within the framework of an overall complex based on geographic circumstances. Furthermore, these circumstances are conditioned principally by the seasonal and highly variable rainfall (Fig. 2). To make a distinction between subsistence and commercial cropping under these conditions is often fictitious, particularly since such a distinction is consequent not on conscious deliberations and crop selections by the peasant cultivators but merely on a question of a surplus. There is a high probability of production falling even below the subsistence level in certain years.

MAPPING TECHNIQUES AND ASSOCIATED PROBLEMS

The base map

Though one-inch topographic maps for the area were available, initial field mapping on such a small-scale base map was considered impracticable: many units of land use are extremely small and there are difficulties in delimiting areal proportions and achieving correct orientation on such a scale. Specially prepared base maps at a scale of 5 inches to the mile were used, containing the following information: contours at 100-foot intervals, principal streams, irrigation works, roads and milestones.

It was decided to limit the scale to 5 inches to the mile because mapping on a larger scale would have had certain practical drawbacks. Work sheets would then have had to be sectionalized even more for

Plate 4.—Ground view of chena, with temporary dwellings made of poles and straw thatch, at end of crop season. Vegetation consists of a complex of crops and secondary scrub. Note watch hut over dwelling to right.

Plate 5.—Aerial view west over forested Rakwana ganga valley showing chenas on steep hill slopes west of Pallebadde. Areas in lighter tones of grey indicate chenas in cultivation. Belts of woodland separate some upland chenas while boundaries of others are less distinct. The forested belt in the valley bottom indicates the reservation along the river. Lowland chena clearings away from the reservation appear at the bottom of the photograph.

Plate 6.—Aerial view east over road north of Embilipitiya showing roadside chenas and/or 'fixed dry' crop units. The substantial looking dwelling and the banana crop around Y suggest 'fixed' cropping. It is a matter of conjecture however whether the uncultivated plot which grades into scrub below X is a current fallow or an abandoned chena. The tendency towards the desiccation of the land due to overcropping is very apparent in the top half of the photograph.

handy use in the field, thereby increasing the dangers of neglecting the relationships existing between one sheet and another. Individual work sheets would have had fewer fixed features to be used as check points during mapping and it would be likely that in highly featureless areas greater emphasis than was actually necessary would have had to be placed on instrument surveys instead of on other field mapping techniques in order to preserve acceptable standards of accuracy. Furthermore, the extra time, labour and cost involved in instrument surveys appeared unwarranted since much of the land-use pattern is so very impermanent.

Accessibility

The major hindrance to the field geographer in the area is the difficulty of movement overland. Roads and tracks are few and much of the ground is under forest. In the lowland areas many cultivated units, especially chenas, were far from roads and not easily accessible on foot (Fig. 1). Other closer units were often hidden from view by belts of forest. In the upland areas to the north access was sometimes even more difficult. This was particularly true of the spur to the east of the road. Here the bed rock of charnokite (basic granite) lies close to the surface and fairly extensive outcrops and steep slopes occur. Arable land is largely limited to the shallow depressions in the central parts of the spur which are hidden by a profusion of scrub growth and forest, and are difficult to locate even from vantage heights.

The spur to the west of the road can be reached only by wading across the Rakwana ganga, a difficult proposition except at very low water during dry spells. Despite steeper gradients movement on this spur is less difficult because the uneven weathering of the bedrock, which here is a mixture of granite, schist, shale and dolomitic limestone, results in more frequent breaks of slope than on the spur to the east. Cultivated units were also less sporadic on this spur since the varied geology resulted in quicker soil renewal and more sustained soil fertility, and the layout was such that most of the land could be viewed from the road or valley bottom.

Aerial observations

In an effort to overcome the difficulties outlined above, initial observations of land-use patterns were made from a light aeroplane.[3] It was possible by this means to make a comprehensive, though speedy, reconnaissance of the overall topography, and in particular to check on the landscape hidden beyond screening forested belts and in the upland depressions, thereby eliminating much tedious time and labour-consuming forays on foot into the jungle. From the air it was also possible to delimit and sketch in by eye the uninhabited forested extents, to note the transition zones between major vegetation types, and to plot the location of small patches of cultivation in the interior

of the forest whose existence was not previously apparent from the ground and might have been otherwise omitted. It must, however, be stressed that aerial observation, interpretation and recording of phenomena is a very subjective art and that the greater one's familiarity with the topography the higher the reliability of such assessments are likely to be (see Plate 1).

Ground mapping

The aerial survey was followed by ground mapping in the areas where land occupance was observed from the air as being sufficiently intensive and complex to merit detailed investigation. Where the land was relatively flat and access easy, areas were measured by pacing and, in places, with a tape. Near roads, milestones and culverts served as check points and elsewhere such features as irrigation channels and wells were so used. In hilly and relatively inaccessible ground the patterns of land use were sketched in where possible from vantage points.

PROBLEMS OF LAND-USE CLASSIFICATION

Though the existence of certain distinctive facets of the landscape in the area such as domestic gardens with dwellings, chena, paddy land, scrub and forest are recognizable, precise distributions and spatial associations are less easily definable. Detailed field classification and mapping of land use presented various difficulties that are conditioned by several considerations and associated problems.

Domestic gardens with permanent dwellings

Domestic gardens in the area are usually privately owned small holdings, generally agglomerated but sometimes independently located. On these holdings individual homes or groups of dwellings are situated amidst a profusion of both cultivated and self-propagated plants and trees (Plate 2). Field lot boundaries in areas of close settlement can often be identified by crude fences or perimeter trees but many boundaries are sometimes obscure. Lot boundaries however have little true meaning from the point of view of tenure since there is much invisible fragmentation. This raises the important question of the extent to which an investigation of land tenure is relevant to a programme of geographic land-use mapping.

The geographer must undoubtedly be conscious of the characteristics of land tenure in order to appreciate its implications on observed land-use patterns. The investigation of tenure as a basis for land-use mapping in areas of close settlement in the tropics is likely, however, to lead to a mass of intriguing details and questions relevant only to tenure.

For instance titles to certain lots are obscure; ancient records cannot be traced; much land is claimed through right of continued occupance; verbal replies as to ownership cannot often be reconciled with title

deeds either because no change has been recorded on the death of the listed owner or because of unrecorded sales or mutual transactions, and many units are not areally divided but are used as one joint unit by households of the same family. These complexities may be elucidated only through a laborious questioning of households—often both a difficult and an embarrassing task. Often false suspicion or ignorance beget evasive or meaningless answers. The seemingly sophisticated and often pretentious questions of the investigator merely evoke curiosity and scepticism: more often than not one succeeds not in obtaining an answer but in merely raising an issue which hitherto was of little consequence to simple folk reared close to nature.

The difficulties that attend the mapping of crop types and distributions and the locations of the dwellings in domestic gardens are equally many and varied. On these units there are many coconuts, bananas, and other perennial tree crops together with annual food crops such as manioc, vegetables and curry stuffs, the cultivation of which is casual. The crop areas are usually minute, crops are often mixed and there is much bare ground and scrub (Plate 2). The volume of produce, apart from coconut and sometimes banana, citrus and other fruit, is small, significant only in the domestic economy. The detailed land use in domestic gardens, which will require a host of symbols and in cases, a combination of symbols, could be plotted with a degree of clarity and accuracy on the relatively large-scale base map used only in very few instances. Most holdings are so tiny that field boundaries, let alone crops or crop combinations and each and every dwelling, could not be shown.

To carry out detailed mapping over a sizeable area under such circumstances could justifiably be termed nonsensical, the more so if such terms as "orchard", "horticulture" and "market gardens" are used. It may however be undertaken over a small extent of ground in order to provide an example, but in most cases a photograph, particularly a low aerial oblique, is likely to achieve better results than a map. There is seemingly no alternative but to map in terms of a significant complex which suggests the details without the need for specification, thereby eliminating, as in Fig. 1, the need to show every field boundary, crop variety and individual dwelling. In the case of the Dry Zone the *gangoda* is one such critical complex.

Gangoda

The customary concept of a gangoda is a unit of ground with close permanent settlement which is related to the availability of domestic water supplies. The water may be obtained from nearby irrigation tanks and channels or from wells. A gangoda landscape is also characterized by the dominance of the coconut palm in the plant associations found in domestic gardens. In the inland areas of the Dry Zone, an area of sporadic underground water, this palm flourishes only in

Plate 1

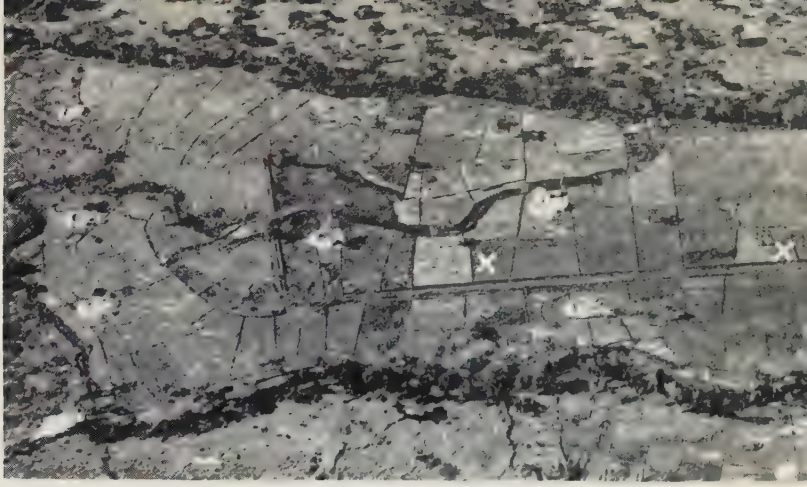

Plate 2

Plate 3

Plate 5

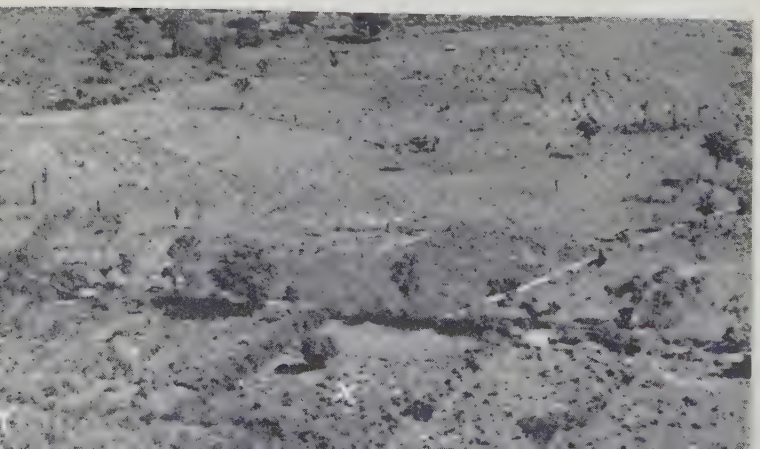

Plate 6

Plate 7

Plate 8

Plate 9

Plate 11

Plate 12

localities with a perennially high water table, a factor of the utmost significance in both the present day and the future permanent agricultural settlement of the Dry Zone.[4] Because of this, the mapping of a gangoda complex is a far more profitable and justifiable field of investigation than the mapping of fragmented holdings and the micro crop distributions that are known to exist.

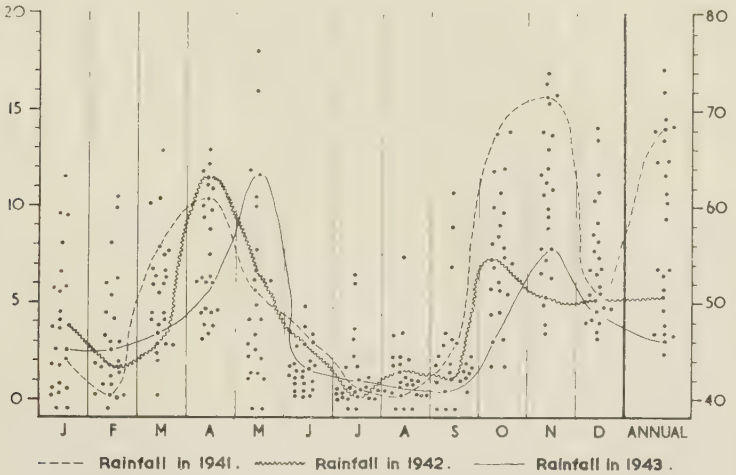

Fig. 2.—Monthly and annual rainfall distribution in inches from 1926 to 1950 at Embilipitiya. Data from Annual Reports of the Colombo Observatory.

The core area of a gangoda is relatively easy to define but its periphery is often obscure; not only because the area of close settlement tends to expand with increases in population but also because the geographer has to map the gangoda not in terms of measurable values but by his appreciation of the attributes of an agricultural complex recognizable on the surface at a given time. The eternal problem of representing what is a zone of transition rather than a fixed boundary thereby presents itself. For example, in Plate 3 the line X—X appears at first glance to be the limit of the gangoda in this sector. But what of the three dwellings shown to the north of that line, and the land around them? They are close enough to the irrigated paddy lands to be possibly in the area of a perennially high water table, and therefore within the gangoda. On the other hand, the character of the clearings suggest that they are recent additions to the landscape and though the dwellings themselves look permanent the vegetation association is more akin to that on a chena.

To make certain, an investigation of tenure and the outlook of the settlers is essential. Have these people obtained permanent title to the land? Do they plan to establish permanent homesteads and develop their holdings with coconut and other garden crops? If the answers are in the affirmative then the area around the three dwellings should be placed within the gangoda, but yet on rather inconclusive

evidence. There is the distinct possibility that the optimism shown by the settlers is based merely on a few years of favourable rainfall; successive droughts might change the picture completely (see Fig. 2). It is also possible that the three dwellings may ultimately serve as road-side shop houses and the holdings left uncultivated; a typical modern trend in many Dry Zone areas. In this eventuality the dwellings would need to be classified independently. But what of the remainder of the ground in the holdings? Is it to be gangoda, chena or scrub?

The evidence in the lower half of Plate 3 provides an example of yet another aspect of the same problem. The secondary scrub vegetation (Y) indicates that these plots have once been cleared for cultivation. In the photograph they look more like abandoned chena clearings than gangoda land. As such, are they an example of the mistaken optimism referred to above? On the other hand had this photograph been taken at the time the plots were under cultivation, most probably with annual crops, one would possibly have had considerable difficulty in deciding whether to incorporate this sector into the gangoda or to map it as chena.

It is apparent from the above examples that some differentiation has to be made between the domestic gardens around the settlement sites shown on Fig. 1. Not all of them are on gangoda lands. For instance, the six settlement sites shown south of the Government Farm, many adjacent to the roadside in the centre of the area and those on the spur to the north can assuredly be adjudged to lie well outside the gangoda cores around the irrigated paddy tracts. They are associated with the other facets of agriculture in the area and their identity can perhaps be fathomed only after a consideration of other land-use types such as chena and perennial 'dry' cropping.

Chena

The mapping of chena land raised a series of problems. Defining chena as a forest clearing on State land, with temporary dwelling or watch hut, much land falls into this category (Plate 4). Its distribution is, however, sporadic. In some parts chenas were found to be fairly frequent over a large area, e.g. Plates 5 and 6; in others the chenas were few and far between. The small isolated chenas in the interior of the forest, invisible from the road, proved the biggest problem (Plate 7). Located only with difficulty from the air or by tramping through the jungle, they are then difficult to orient correctly.

The mapping of chena boundaries presents many difficulties and much depends on the time at which the land is observed and mapped. The area to be mapped as chena is a matter of conjecture particularly at the commencement of the chena season when the forest is being fired (Plate 8); the resultant clearing is often larger than that put under cultivation. At the height of the season, the delimiting of cropped

areas is comparatively easier but there is always much scrub and dead vegetation interspersed. Later, towards the end of the crop season, the secondary vegetation gains ascendancy over the declining crops (Plates 9 and 11). Furthermore many chena units are worked jointly by groups of people, with each gathering a share of the produce. The concept of individual holdings has therefore little meaning and one finds difficulty in even ascertaining the number of families concerned since chenas have no people on them for very long periods.

For all these reasons and because of the basic fluidity of the chena system, boundaries between chena units were, in the survey, drawn only when there was a significant transition between cultivated ground and forest or when a crude fence or belt of trees separated one chena unit from another. In the uplands to the north (Plate 5), where chena areas are even smaller than in the lowlands and where only selected slopes on each unit are cultivated, no attempt was made to map the cultivated and uncultivated extents; the entire holdings or groups of holdings were mapped as one chena area.

In addition to these territorial aspects of traditional chena, present day functional changes give rise to other complexities. To-day, for reasons pointed out earlier, chena serves both a subsistence and a trading economy. As a result, the indigenous practice of land rotation at the end of each crop season has broken down and the use of the land has become even more complicated and changes are kaleidoscopic.

Many 'dry' crop units in the area were found planted not with the customary food grains and other annual crops, such as millet (*Eleusine coracana*), maize, currystuffs and vegetables, but with banana, papaya and pineapple. But even these crops may not necessarily be perennial. A unit cultivated with tree crops such as banana and papaya may, if the crop is successful, be kept in cultivation for a number of years and thereby assume the character of a fixed unit of cultivation. On the other hand an adjoining unit growing vegetables and millet at the commencement of the rains, may be abandoned once the initial crop is harvested, not to be cultivated again for an indefinite period; or it may be cultivated year after year until the land is completely dessicated (Plate 6). A chena which produced well in 1941 might have been replanted in 1942, in the hope of another wet year, and then not have been harvested because of the relative failure of the crop consequent upon the low rainfall during October, November and December (see Fig. 2). Were it planted again in 1943 certain dessication of the soil would have occurred by the end of the crop season. Another unit may be cultivated with a purely trade crop—such as cotton, gingelly (*Sesamum indicum*), mustard or tobacco—for one season and temporarily abandoned once the peasant has sold his crop. The same unit may in the next season be planted with a more substantial crop like coconut or cultivated again with the same trade crop.

The development of fixed cropping units

The development of multi-category economic functions in chena, a hitherto simple agricultural system, is worthy of further investigation. It marks the beginnings of fixed land occupance, the stabilization of land use within a different orbit, and the emergence of trade crops as a dominant element in the economy. The decline of traditional chena and the rise of permanent land use are a reflection of increasing population and the growing pressure on the land. In land-use mapping, however difficult, this changing situation merits a differentiation between chena and 'fixed dry' cropping. Inquiry into tenure is once again necessary to establish the differences and in this instance it appears fundamental because chenas, whether for subsistence or cash crops, are usually on State land. The cultivation of perennials or crops in rotation on fixed units is on the other hand more likely to be on land to which the peasant has secured permanent title or is expecting to do so in the near future.*

In certain areas where 'fixed dry' cropping was advanced, field boundaries were readily discernible as in Plate 10, and could be shown on the base map. Mere reconnaissance is, however, unlikely to achieve complete authenticity since fixed crop units in their early stages are not ecologically dissimilar from chenas. It is also not unlikely that 'fixed dry' cropping may be found on lands unalienated as yet, just as much as there is illicit chena on State land. One cannot be certain even on the evidence of a tractor clearing the land; this may signify the beginnings of a State or privately sponsored 'dry' cropping project but it is dangerous, as experience has shown, to form firm opinions. To ascertain the true legal circumstances and the nature of land occupance each 'dry' cropping plot has to be investigated fully. Official records are neither comprehensive enough nor easily accessible. Field inquiry is a harrowing and often unrewarding task. One has to catch a cultivator at work or track him down in the village. Even so the not untruthful answer "I don't really know" is not uncommon.

* Chena is officially allowed under annual licences at a small nominal charge. Alienation of State land is subsequent to the Land Development Ordinance of 1935. Roughly 0·25 million acres have been so far granted to needy peasants.

Plate 7.—Aerial view of tiny chena in high forest located over a mile from the road—the field man's nightmare.

Plate 8.—Chena clearings at the start of the crop season. Ultimate crop areas are undefinable at this stage. For example, it is not certain whether the imperfectly cleared patches around X will be cultivated.

Plate 9.—Aerial view southwest over road (bottom left of photograph) showing the largest paddy tract served by the Rakwana ganga in centre (X) surrounded by jungle in various stages of regeneration on abandoned chenas. Local relief necessitates the shallow terracing of the paddy land. Chenas in cultivation are shown in top left of photograph.

Under such vague and uncertain conditions, the only practicable way of mapping a sizeable area of ground is probably to carry out a series of periodic observations preferably by air. This may help to fix the core areas of stabilized 'dry' cropping, through an interpretation of the topography with particular reference to the occurrence of specific indicators such as trade crops and permanent dwellings (Plate 10). Many of the permanent settlement sites and adjacent cultivated areas away from the gangoda cores in Fig. 1 are indicative of this trend. Transitions between true chena and 'fixed dry' cropping will nevertheless always be evident.

Apart from the problem of differentiating between chena and 'fixed dry' cropping, it is apparently necessary to indicate crop types and their functions, since these considerations are suggestive of economic changes and associated social implications. The extent to which this is possible varies with the use to which a unit of cultivation is put. For example, along the road leading west from Embilipitiya the three 'fixed dry' crop units shown were under banana, gingelly and mustard respectively. On such relatively large mono-cropped units it is possible to indicate crops by symbols and also to show that they are essentially trade crops. Similarly one could readily classify the large unit in the centre of the area to the east of the main north–south road as being under trade crops of pineapple and banana, and the large unit in the extreme north of the area as under papaya, meant exclusively for trade alone. On other units shown as 'fixed dry' crop units on Fig. 1, no such firm distinctions could be made. Money crops such as cotton, tobacco, gingelly and banana predominated but there were also many basic food crops such as millet, maize, chillies and vegetables, portions of which were for local consumption and others very obviously for trade. What does one do under the circumstances? It will no doubt be possible theoretically to make provision for all contingencies by evolving a host of symbols. But in view of the highly changeable circumstances of 'fixed' cropping previously outlined, is there any practical advantage to be gained by so doing? Furthermore, cartographic difficulties are certain to preclude the final presentation of all the variables. Similar difficulties apply to the mapping of specific

Plate 10.—Aerial view eastward from above Hingurara tank of area east of the road, showing the beginnings of fairly extensive 'fixed dry' cropping. Note the comparatively well defined field boundaries, substantial dwellings and sizeable crops of bananas.

Plate 11.—Aerial view showing the distinct boundary X—X—X—X, between areas of scrub on recently abandoned chenas and older stands. The area in the foreground with hut to left of Z, though seemingly a scrub-covered abandoned chena, was found on inspection to carry a large quantity of gourds, water melons and pumpkins.

Plate 12.—Aerial view of part of east flank of spur to the east of the road showing expanses of bare rock, stony unproductive ground and climax or sere-climax associations of stunted trees and scrub.

crop types on true chenas cultivated with the customary food grains and other annuals.

Another important question which arises when chena and 'fixed-dry' cropping occur side by side, is that of making a distinction between abandoned chena land and a current fallow consequent on deliberate crop rotation. For example, is plot X on Plate 6 current fallow in relation to plot Y in crop, or just an abandoned chena? If it is not an abandoned chena then a symbol is necessary to show that it is a unit on which 'dry' farming techniques are being applied. If it is an abandoned chena, then it must be shown as secondary vegetation of some kind. This leads on to the problem of classifying and mapping vegetation on unoccupied ground.

Scrub, jungle, forest and pasture

Mapping difficulties are largely consequent on the incidence of chena. Within areas of active chena cultivation transitions are chaotic and plant associations, mainly scrub and low jungle, are highly variable in respect of stage, species and extent (Plate 9.) Marked transitions from these lower forms to higher associations were, however, discernible as in Plate 11 along the periphery of very recently abandoned chena areas or contemporary units of cultivation. These distinctions are most obvious where the more recent secondary vegetation abuts on forest reservations particularly those along the rivers, roads and in certain upland tracts (Plate 5).* It is only within the reservations that the high forest is relatively dense and uniform in stature, but in other forested areas transitions are evident with the character of the forest depending on the period of abandonment after chena. The forests consist mainly of hardwoods with evergreen species predominating over the deciduous. Among the more useful trees are halmilla (*Berrya cordifolia*), satin (*Chloroxylon swietenia*), milla (*Vitex pinata*), palu (*Manilkara hexandra*), ranai (*Alseodaphne semicarpifolia*) and ebony (*Diospyros ebenum*). But since the stands are highly mixed no zoning of types is possible.

However, apart from showing the major transition between scrub and low jungle on the one hand and forest on the other as in Fig. 1, there are other significant possibilities. It would be profitable both from the point of view of current agriculture and future planning to indicate where the low scrub is a climax association. For example the scrub on the rocky spur to the east of the road is one such association. Cropping in this area is always likely to be unrewarding (Plate 12.). Again, it might be desirable to indicate highly dessicated areas supporting sere-climax associations consequent on over-cultivation,

* The Forest Ordinance of 1907 prohibits forest clearing for chena within 100 feet of a main road or 50 feet of a stream. The Land Order of 1940 prohibits forest clearing on slopes over 30° and on hill tops. Plates 5 and 6 however suggest the implementation of these regulations to be casual.

as in parts of Plate 6, as temporarily unrewarding. Finally it may be worthwhile to indicate open forested zones where grassy glades are prominent. Though the area carries a large number of cattle and buffalo, the paddy fields during fallow periods provide the only sizeable rough pastures. Other tiny patches of pastures are found scattered around the alluvial tracts, on the margins of streams and in certain parts of the forest. Despite their significance in the economy the mapping of these tiny units was well nigh impossible even on the large-scale base map used.

The classification and mapping of vegetation types on unoccupied ground in this area can be considered even more subjective than the occupied categories of land described previously and zonal boundaries are likely to represent even wider and more obscure transitions. In fact the only category of land use where the question of boundary definitions and transitions does not arise is the paddy fields.

Paddy land

The paddy land is the most stable facet of the landscape. As rice is grown under irrigation, the overall extent of the fields is related to the available facilities for irrigation provided by the tanks and anicuts.* The Hingurara and Embilipitiya tanks (Fig. 1), with full surface areas of 43 acres and 36 acres and capacities of 340 acre feet and 200 acre feet respectively, are comparatively small in relation to others elsewhere in the Dry Zone. Together the tanks serve an estimated 535 acres of paddy land. The anicut on the Rakwana ganga provides water for about 300 acres of paddy land (Plate 9). There is generally only one rice crop per year on the fields irrigated from the tanks except in years of exceptionally high rainfall. On account of the small catchments, which are entirely within the Dry Zone, and the small capacities of the tanks even the single crop, grown between October and February, is an unreliable one during dry years. Cultivation is less uncertain on the tracts served by the anicut on the Rakwana ganga whose headwaters are in the Wet Zone. The water supply is consequently fairly reliable and a second crop, grown between April and August, is often possible.

It may be considered valuable to show these highly significant features of rice production, particularly the higher reliability of output and the probability of a double crop on areas irrigated from the anicut. There is little difficulty in doing so, but it must be remembered that the validity of such differentiations will depend solely on the rainfall from year to year. Likewise, if the field investigations are carried out during or just after highly productive harvests, when there is a strong possibility of a surplus and even a sizeable export of rice, one may with good reason be tempted to indicate these features. But in reality

* Tanks are storage reservoirs formed by building earthen dams across rivers and streams. Anicuts are low barrages or weirs for diverting part of stream flow.

average production barely exceeds the subsistence level and in individual years may be well under the mark. No subsidiary crops being grown on the paddy lands, the question of representing multicrop distribution does not arise, although the fields when not under crop do serve as rough pastures. This approximation to a grass fallow is, however, not only evident throughout the fields in between normal cropping seasons, but may also occur on individual plots during a recognized crop season on account of water shortages.

Problematic as the above issues are, they are overshadowed by the intricacies of land tenure on paddy lands. Here the mapping of field lots not only raises problems allied to those previously outlined with reference to gangoda holdings, but certain peculiar issues as well. Paddy holdings are frequently not only tiny but also non-contiguous. An individual or family may have three or four small plots scattered over the fields. All holdings, both large or small, can no doubt be mapped by adapting the scale of base maps; but the results will achieve their full significance only if it were cartographically possible to identify each plot with the owners. Further difficulties are imposed by complicated systems of joint ownership, share-cropping, and also vestiges of old communal farming practices. For example, under a system known as *thattamaru*, a joint holding is worked each season in sequence by only one of the owners. Again, much land is also worked under the *ande* system of tenancy, whereby the owner receives a half share of the crop, and a distinction between owner-worked and tenant-cultivated holdings is therefore of significance. But such distributions are likely to vary from season to season. Finally, there is the possibility of the above complexities being resolved during certain crop seasons if and when the old communal practice of *bethma* is adopted. Under this custom a part of a paddy field is cultivated jointly and the produce shared when the water supply is insufficient for all the holdings. This practice, though by no means universal to-day, is yet probable among certain owners and tenants within a community.

The field geographer must undoubtedly be aware of the above considerations, but in most cases circumstances will compel him to be satisfied with small samples illustrating the various complexities rather than comprehensive maps.

CONCLUSION

Mid-latitude techniques, criteria, classifications, categories and nomenclatures do not fit tropical conditions and do not produce effective land-use maps. This is particularly true for areas in which traditional agricultural systems have long been developed through recognition of very real ecological variation in environmental situations within short horizontal distances and over successive periods of changing annual conditions. The changes in these traditional economies through

political and economic pressures arising originally from outside the tropics, but currently from within tropical lands, themselves further complicate the problem of land-use mapping. The maps are urgently needed by many agencies in the development of lands hitherto not fully settled and in the planning of more effective use of lands long occupied.

To the single geographer, tropical land-use mapping is often a frustrating project. Much of the correlated and detailed information presentable on large-scale work maps has invariably to be highly sectionalized or even omitted, because of cartographic difficulties and considerations of economy, by the time it is reproduced on a reduced scale and made available in quantity to the profession. Furthermore, the inherent characteristics of much of tropical agriculture, particularly the impermanence of many of its facets, make for qualitative rather than quantitative assessments, and the need for very frequent revision of such findings. The only way in which one can conceivably approximate the degree of quantitative evaluation possible in occidental mid-latitudes, is to apply repeatedly the techniques of mass observation and mapping, particularly of recognizable complexes, over the same area. It is this compelling requirement more perhaps than any other feature, that makes this aspect of geography so continuously absorbing, and it is primarily through this constant direction of attention to changing circumstances that the field geographer can be of assistance to national planning and development.

There is great need for many experimental mapping programmes which can sample quite varied local environments in an effort to discern the techniques, classifications and nomenclatures that can be applied to the whole of the tropics with a more uniform degree of success than now comes out of the application of standard mid-latitude procedures. This article has discussed one major environmental complex; however, the procedure and mapping conventions here suggested would be neither suitable nor applicable in, for example, Malaya or New Guinea.

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[2] For a fuller description of this complex see R. Wikkramatileke, "Hambegamuwa Village: an example of rural settlement in Ceylon's Dry Zone", *Economic Geography*, vol. 33, 1957, pp. 362–73.

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[A review of recently published Land-Use Maps of the Gambia on p. 138 of this issue is of interest in relation to Dr. Wikkramatileke's article.—Ed.]

Statistical Map-Reading

JOHN I. CLARKE

ISAIAH BOWMAN rightly said that "Geography is only in part objective science",[1] for the geographer not only has a subjective viewpoint in the assemblage, interpretation and presentation of facts, but his impression of a completed work is also markedly personal. Many have stressed the fact that the map, one of the geographer's essential forms of expression, is far from being totally objective. Indeed, a personal element enters into all map-making, including the construction of those maps termed statistical or quantitative.[2] The apparent simplicity of such maps, however, often deludes us into thinking that they are quite objective and accurate. This is far from the truth.

There is a degree of subjectivity present in several aspects of the making of statistical maps:

a. The skill, techniques, knowledge and aims of the cartographer.
b. The diversity and quality of data.
c. The generalization or simplification of quantitative data,[3] in accordance with the mapping method chosen and the aims of the map-maker.
d. The amplification of quantitative data by the use of additional related evidence,[4] so that a more accurate distribution may be produced, e.g. the dasymetric technique.[5]
e. The choice of base map, so often indiscriminate, and the incorporation of material from the base map, particularly administrative boundaries.
f. The choice of method.

Four basic methods are available—isopleths (isolines), choropleths, dots and proportional symbols—of which certain combinations are possible. In all four methods inherent variables permit subjectivity to enter into the preparation of the map:

Isopleths[6]

a. Location of control points.
b. Isopleth interval, including the problem of progression.
c. Construction and interpolation of isopleths, especially difficult for density or ratio maps, and for areas where there is a rapid transition of density.
d. Shading method—i. Graded shading may be proportional or non-proportional; ii. Grading may be achieved by the use of

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colour, dots or line-shading of various types, as well as by combinations of these.

e. Shading range—i. Number of shading grades; ii. Density of grades.

Choropleths

a. Class interval, including the problem of progression.

b. Shading method (as in *d* above).

c. Shading range—density of shading grades only, as the number invariably conforms to the number of classes.

Dots

a. Size of dot, and the difficulty of maintaining a uniform size.

b. Value of dot, and the problem of contiguity of dots.

c. Location of dot.

Proportional symbols

a. Type of symbol—i. pictorial; ii. literal; iii. geometric. Geometric symbols may be one-, two- or three-dimensional.

b. Value per unit length, area or volume.

c. Location of symbol.

d. Detailed construction of symbol. An important aspect is whether the bulk of the symbol is black or white.

So even simple distributional data may be represented cartographically in a host of different ways, none of which is wholly satisfactory and all of which tend to create different visual impressions of the actual distribution.

STATISTICAL MAP-READING

Variability in statistical map-making is paralleled by variability in visual perception of these maps. Perceptual differences in map-reading may have been too often ignored, perhaps because although visual impressions of the pattern of conventional signs on a topographic map are undoubtedly diverse, they are not easily measurable. It is just as difficult, for example, to assess different impressions of a painting. We know, of course, that map interpretations are quite individual, and that experience tends to reduce their diversity, though no doubt many cases may be cited to the contrary! It is difficult to prove, however, that experience reduces diversity in visual impression.

It is easier to measure perceptual differences in statistical map-reading for they are quantitative rather than qualitative. Moreover, statistical maps are unlike topographic maps in that the former normally show only one distribution and so visual impression and interpretation of this distribution are difficult to distinguish from each other.

In fact, we make estimates of dot densities, shading densities or proportional symbols by contrasting them with other densities or

symbols, after reference to the key. The key should largely help to standardize visual evaluation of choropleth maps, because it covers all eventualities. On dot maps, however, it merely states the value of one dot and is thus uninformative as far as density is concerned. As for the key to maps of proportional symbols, it is usually just a guide and the map-reader has not only to contrast a symbol with its neighbours, but also with the few sample symbols in the key. No wonder our estimates are so inaccurate and so varied.

Inaccurate visual evaluation of statistical maps seems to be general. For the dot map, the work of O'Dell[7], and later Mackay[8], showed that an increase in the density of dots is usually underestimated visually. We shall see later that a similar optical illusion occurs in the evaluation of proportional symbols. Likewise, preliminary investigations seem to indicate that proportional shading does not produce the required effect. General visual impression may not conform to shading density. A more common cause of inaccurate visual evaluation is the difficulty in discriminating between two insufficiently contrasted shading grades or two similar adjacent dot densities.

The few results available and the work of psychologists in the field of form perception suggest that individual differences in visual impression of statistical maps are equally significant.

Visual evaluation of proportional symbols

It is interesting, therefore, to examine these two assumptions of general error and individual variation in the visual evaluation of proportional symbols. Undoubtedly these assumptions are made by many geographers, but the literature includes only one important study,[9] ignored by textbooks of cartography, and few other references[10] except in psychology texts.[11]

We have noted that proportional symbols are pictorial, literal or geometric, but the first two are less frequently used by geographers. On the one hand, pictorial symbols, although often graphic, are difficult to draw uniformly and much generalization occurs, while on the other hand it is misleading to vary the height of letters according to the number because of their varied areas. Also both pictorial and literal symbols are obviously very difficult to evaluate visually.

The most common geometric forms are:

1. Bars and lines, proportional linearly.
2. Squares and circles, proportional areally.
3. Cubes and spheres, proportional volumetrically.
4. Block-pile graphs, proportional volumetrically.

The advantage of the two-dimensional symbol over the linear symbol is that it enables graphic representation of a greater numerical range, and, of course, for this purpose the three-dimensional symbol is still more useful.

There are several varieties of each of these symbols. Two-dimensional symbols may be black or white with black outlines. Cubes may be drawn with one or two-point perspective or isometrically, the last being the most favoured as it is the easiest. Nevertheless, some line drawings of cubes are easier to see in three dimensions than others.[12] A sphere may be drawn in many ways, but it is commonly a projection or a black ball with light shining on it from the northwest. The final touches greatly affect the finished product and our estimates of its numerical value. For example we judge black squares and circles to be rather smaller than open ones, and so the practice of employing both of these varieties of symbol on one map is to be discouraged.

A test of visual evaluation

To test the accuracy, error and variability in estimates of bars, circles, squares, spheres and cubes, 9 separate cards (Fig. 1) each containing three symbols were shown individually and at random to 33 second-year geography undergraduates. Each student was asked to compare the sizes of the smallest and largest symbols with that of the central key symbol, and to record his estimates on a personal form. The cards were designed to assess ability in estimating symbols 5, 25 or 100 times larger or smaller than the key symbol. The proportion of the smallest symbol to the key symbol was always the same as that of the largest symbol to the key symbol, but this was realized by only two of the students in a few of their answers.

Several problems arose in the arrangement of the test. First, the estimating of proportional symbols is a comparative process; symbols may be examined as absolute numbers or as multiples of the key symbol. As most observers think first of multiples, the students were asked to give their estimates in this manner. Secondly, it was impossible to show more than three sizes of symbol on each card because of the danger of cumulative error in estimates. There is no doubt that cumulative error occurs in our estimates on maps, due to insufficient and infrequent study of the key, but this error may take place in many different ways, difficult to analyse statistically. Thirdly, unlike Croxton and Stein,[13] the one- and two-dimensional symbols were represented in solid black, and part of the three-dimensional symbols in black also (Croxton and Stein did not examine spheres). Fourthly, following Croxton and Stein's conclusion "that it makes no difference in the accuracy of estimates whether the figures be centred or drawn upon the same base line", circles and spheres were centred and lines, squares and cubes were drawn along the same base line for the sake of convenience. Finally, spheres were represented as black balls rather than as projections, because of their easy construction and increasing popularity. It is not implied that the estimates of black balls and projections are similar. Indeed, a further projected topic for study is the comparison

of estimates of different types of spheres and cubes. The results are obviously applicable only to the symbols studied.

Results

All the estimates are shown on Figs. 2 and 3, from which certain general conclusions may be drawn. Firstly, the medians (middle values) and quartiles indicate that the students estimated symbols larger than the key symbol slightly better than those smaller. As one might expect, estimates are naturally much better when there is a small difference between the symbol and the key symbol than when the difference is large. More important is the fact that only one in twelve of the total estimates were accurate, and that nearly four in five were underestimates:

Percentage of estimates	*1 dimension*	*2 dimensions*		*3 dimensions*		*Total*
	Lines	*Circles*	*Squares*	*Spheres*	*Cubes*	
Accurate	37·9	6·1	8·3	3·0	1·5	8·4
Overestimated	22·7	15·9	9·9	12·9	6·1	12·5
Underestimated	39·4	78·0	81·8	84·1	92·4	79·1

The significant differences in this table of accuracy and also in the degree of error of estimates are related to the number of dimensions of the symbols rather than to their form. The more dimensions and the greater the difference between the symbol and the key, the greater is the error and the less accurate the visual evaluation. The following table is helpful for comparative purposes:

Times greater or smaller than key symbol	*Number of dimensions*	*Form of symbol*	*Medians of estimates expressed as percentages of actual values*	
			Symbols smaller than key	*Symbols larger than key*
5	1	A Lines	80	100
	2	B Circles	80	80
		C Squares	80	80
	3	D Spheres	40	60
		E Cubes	40	60
25	2	F Circles	40	64
		G Squares	64	68
100	3	H Spheres	8	12
		I Cubes	13·5	12

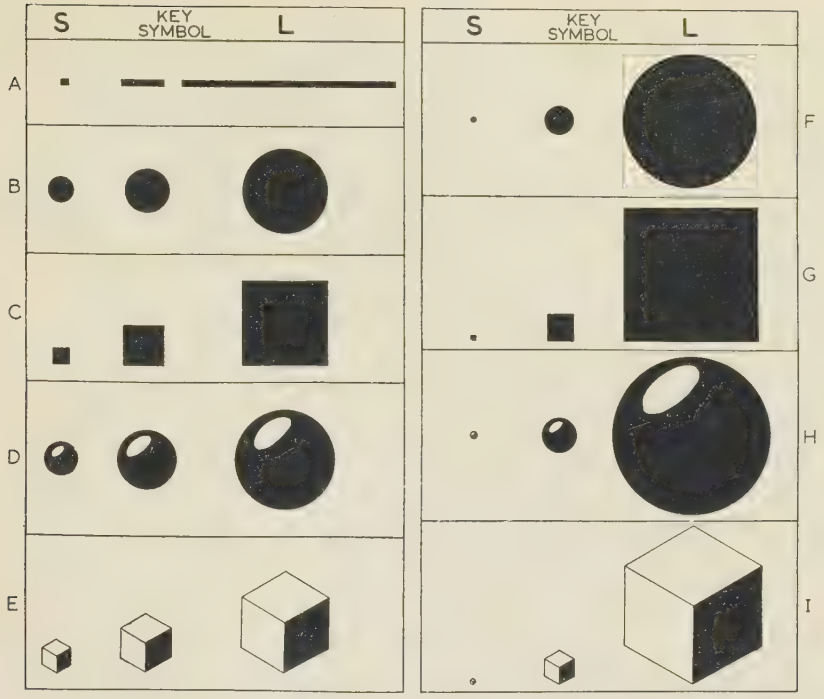

Fig. 1.—Nine separate cards (A to I) were shown to each student, with the questions "How many times is 'S' smaller than the key symbol?" and "How many times is 'L' larger than the key symbol?" In this composite diagram the symbols are many times smaller than in the original.

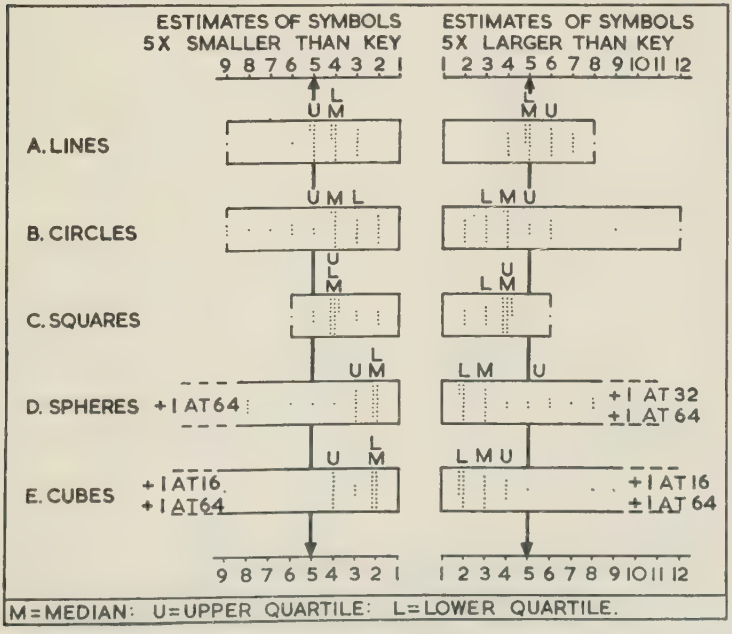

Fig. 2.—Student estimates of cards A to E, on all of which the symbols were five times larger or smaller than the key symbol. Accuracy of estimates deteriorates with increasing number of dimensions.

It will be noted that for symbols five times larger or smaller than the key the medians of estimates are the same for circles and squares, as well as for spheres and cubes. Fig. 3, moreover, on which are plotted the estimates of the symbols differing greatly from the key symbol (Cards F to I), reveals that although there is slightly less error in estimates of squares than circles, there is still no significant difference in estimates of spheres and cubes. It is interesting to note that in only one of the 18 sets of estimates—that of lines larger than the key symbol —does the mode coincide with the correct answer.

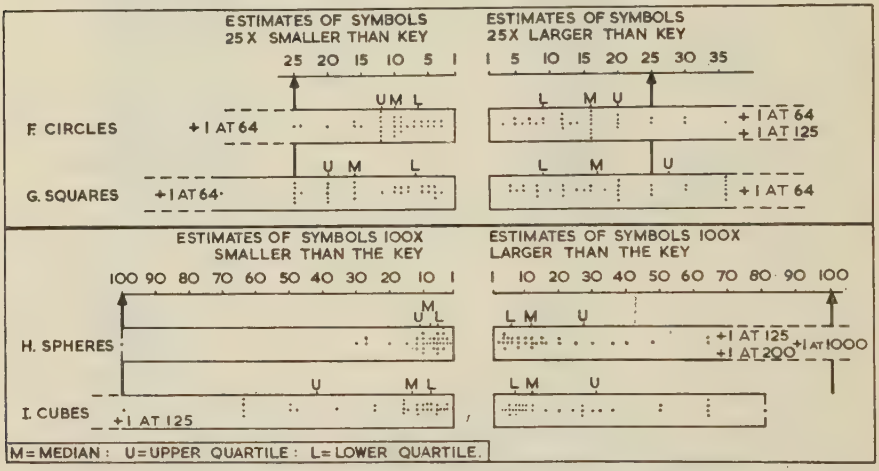

Fig. 3.—Student estimates of cards F—G, and H—I, on which the symbols were respectively twenty-five and one hundred times larger or smaller than the key symbol.

The diversity of estimates also increases with the number of dimensions of the symbol and with the difference between the symbol and the key, although in most cases the interquartile ranges are fairly small. Every other estimate was different for the three-dimensional symbols one hundred times the key (H and I), whilst there were only five different estimates of the lines.

We have mentioned already that the great majority of students failed to realize that the proportions of the largest and smallest symbols to the key symbol were identical. Frequently a student estimated the proportion of one symbol to the key many times greater than that of the other. However, on the whole students were consistent in their 18 estimates; consistently good, bad or mediocre. The best managed 7 correct estimates out of 18. Of the others, none made more than 4, and nearly one-quarter made no correct estimates.

Recommendations

The following recommendations to student cartographers seem pertinent:

a. Wherever possible, each map should include only one type of symbol. If many sets of similar data must be mapped, every

map should have the same symbol and, again where possible, the same scale. The visual perception of the map-reader is then not too greatly taxed.

b. After examining the numerical range of the data, the cartographer should select a symbol according to the ease of visual evaluation, ease of construction and adequacy for location. He should remember that difficulty in visual evaluation of proportional symbols increases with the number of dimensions of the symbol, so that with data of a small numerical range, he is sometimes justified in using bars despite their poor locational value. Perhaps two-dimensional symbols meet all the conditions most satisfactorily, and so are valuable for general purposes. Three-dimensional symbols suffer from the disadvantages that they are difficult to construct and to estimate and involve much generalization of data. However, a large numerical range often necessitates their use. Also they are often artistically pleasing.

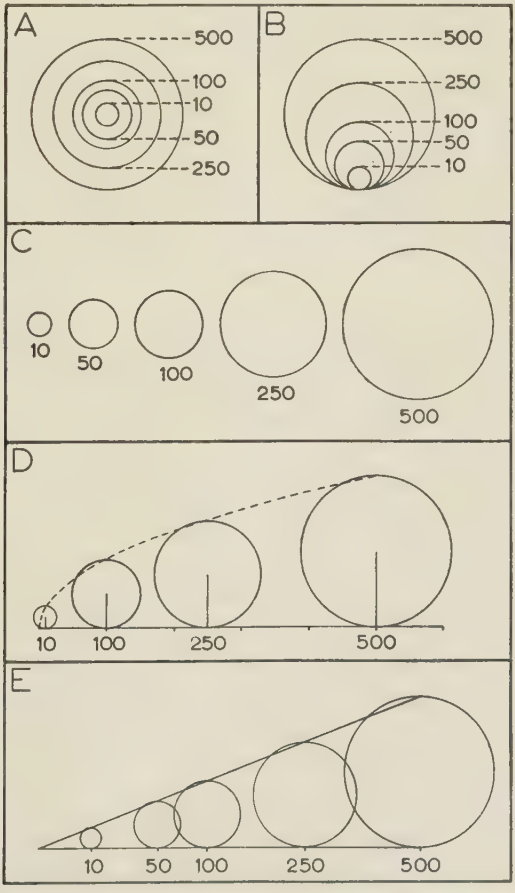

Fig. 4.—Five common keys for proportional symbols. Similar methods are used for spheres, squares and cubes.

Raisz's block piles[14] undoubtedly facilitate visual evaluation and are no more difficult to draw than spherical projections, especially when isometric graph paper is employed.

c. Visual evaluation is improved by the use of one symbol in standard sizes, all of which are shown in the key. Towns are often classified according to size in this way.

d. The key is of utmost importance in the visual evaluation of proportional symbols, so great care should go into its construction. Many types are current, as shown in Fig. 4 where the circle is the example. Methods D and E are certainly preferable for visual evaluation, and once again construction is simple.[15] Methods A and B are poorer than C, but are better for calculation of values by dividers.

e. Overlapping symbols, which make visual evaluation extremely difficult, can be avoided by making larger-scale insets. No change in the scale of symbols is necessary.

f. Unless place-names are indispensable to the understanding of the map they should be omitted, for they influence the impression of distribution.

Although professional map-makers have constantly in mind the requirements and capabilities of the map-reader, many amateurs forget all about him. Accurately drawn maps are not always accurately read. The statistical map-maker should make every endeavour to present his data in such a way that the map-reader gains an exact impression and makes an exact interpretation.

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[13] F. E. Croxton and H. Stein, *op. cit.*, p. 55.

[14] E. Raisz, *op. cit.*

[15] See F. J. Monkhouse and H. R. Wilkinson, *op. cit.*, pp. 22–5. An excellent résumé.

Farm Studies in School Geography

JUSTIFICATION FOR THE INCLUSION OF FARM STUDIES in a school course of geography—if justification is needed—is not far to seek. We live by farm products and confidently assume that our regular daily supplies of bread, milk and meat will not fail. But often our knowledge of what lies behind the appearance of the loaf on our table or the milk bottles on our doorstep is sketchy and unrealistic. It is common to find school leavers, and adults too, who cannot distinguish oats, barley and wheat in the ear; ley farming is an unfamiliar term in spite of the fact that it leaves a characteristic and readily recognizable imprint on the landscape of much of our countryside.

But this question of farm studies is only a part of a far wider issue in the teaching of geography. No school syllabus can hope to cover the world. "The trouble with geography is space", and we must always be faced with the need to select. The samples we take must include a wide variety of different human environments, but among them types of farming should surely rank high. The criteria by which we make our selection may be many, but undoubtedly our samples should include places where work essential to the life of man goes on and where the effect of this work is to produce a distinctive landscape. Farm studies will be included in a choice based on either or both of these criteria. Understanding of the complex essential work of a farm requires practical knowledge of crops at various stages of growth, of farm machinery and how it does its job, of the cropping plans necessary to the maintenance of animals. Such knowledge is convincingly gained by seasonal visits to a farm, but if this is quite impossible such excellent studies as those produced by the Association of Agriculture will go far to counteract unrealistic generalizations about farming.

Farm studies lead almost inevitably to the study of a market town where a single visit will show how the farmer transports his products, sells them and buys some of the supplies which he needs, and how the whole market area is designed to meet the needs of a farming community.

Real understanding of British farms provides a yardstick by which to measure the work and production of overseas farms and establishes

➤ The papers published under this title are based on contributions by the authors to a symposium on this subject organized by the Secondary Schools Section at the Annual Conference of the Geographical Association on Thursday, 2nd January, 1959. Miss Young, principal lecturer in geography at Whitelands College, Putney, London, who contributes the introduction to the two articles, opened the symposium with an illustrated talk on the theme of farm studies in school geography. Her booklet on the topic, published by the Association of Agriculture, is reviewed on p. 141 of this issue.

the important idea that all farms base their production on common elements, soil, climate, man's skill and economic demand, whether the end product be milk or wine, rice or wool.

By such studies we can hope that behind the familiar loaf and bottle of milk will lie the story of a field of wheat or a fascinating study of grass management.

I. V. Young

Farm Studies in a Primary School

I. A. BLACKLEY

The work described here was done in a primary school in northwest London—the extreme urban environment, where grass is what is found in some parks and is unknown by many in its natural state in the countryside. A child may know that Eskimos rely on blubber for food; he may know how they acquire that food; but he may have no idea about the source of the milk he drinks. In embarking on farm studies, using the Association of Agriculture Farm Adoption Scheme, the author hoped to achieve a completely realistic approach, to combat lack of knowledge and the romantic ideas acquired by the children in reading and films.

The first farm we adopted was Holmfield, at Fridaythorpe, near Driffield in the East Riding of Yorkshire. This is a mixed farm on the Yorkshire Wolds, with cows, sheep, pigs and poultry, and arable crops. It was selected because it seemed the easiest to teach about and the easiest to illustrate in a junior school; knowledge of the care and feeding of animals might make the greatest appeal to young minds. The class numbered 37.

With the guidance of the map of the farm in the Adoption Scheme folder, we made a map (paper) in class, putting in the name of each field and how it was being used during that year. We then returned to the farmhouse and the farmyard, of which we made a model from the information given in the descriptions, maps and pictures. We discussed cocks, hens, eggs, chickens, and cockerels; we made model henhouses; and the head teacher, who kept hens at the bottom of her garden in High Wycombe, brought samples of chicken food. We learned that the farmer's wife not only deals with poultry, but often markets the eggs too. Next we studied the dairy herd, using the Puffin Book on cattle for pictures and information. We discussed different ways of milking, TT attested cattle, fodder, cattle cake, how and why

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cows chew the cud, and the marketing of milk. For this work, the filmstrips *Farm Animals*, *On the Farm*, *Your Bottle of Milk* (by Educational Productions) and *The Stockman* (by Educational Supply Association) were helpful. We found out about store cattle and how they are bred and raised for beef.

Sheep and lambs were our next study and again we approached this in a practical way, learning about the animals themselves and modern farming practices. We grew a crop of grass in the classroom, using a deep sand-tray, and stood in it toy lambs and sheep. We learned about tail-cutting, dipping and shearing; about the Border sheep and lamb sales and about summer lambs making lean joints; about the way wool is baled and sent off for spinning and weaving into cloth.

At this period, Holmfield Farm had pigs as well—the farmer stopped keeping them later because of staffing difficulties, but we see by this year's letter from him that his son is interested in them and that he intends to rear them again. He formerly bred Yorkshire Whites to get nice lean bacon, the "housewife's choice", an illustration of how mother's choice influences the farmer in what he breeds.

After these studies, we returned to the map to study the lie of the land. We saw where the farmer had sown wheat, and where barley, which involved considering climate and soil and asking ourselves questions about these geographical factors. Specimens of wheat and barley were easy to obtain, for in London both are sold for decorative purposes by flower shops. The children were familiar with the cereals as the bases of their breakfast foods. Root crops —swedes and turnips— are both sold in London.

After lessons of this kind, extending over almost two terms, we began to find out why Mr. Coleman, the farmer, chose the stock he did and where he bought it, or why he bred it himself. We found out what he sowed in his fields and why he sowed it particularly where he did. We did not go into rotation of crops which I considered too difficult for the children's understanding at this stage. We knew which were grown as fodder crops and which were grown to be sold. During all this study the farmer, his wife and their family of four children became for us very real people, whose lives we were sharing.

At last each child chose a job on the farm; we invited in another class, the head teacher and others to enjoy our models, and to hear each child describe his or her farm job. The one question I had failed to answer at the end of it all was "When are we going to visit our farm?" This was the more poignant when I showed the children a filmstrip of Yorkshire school children visiting Holmfield Farm. Though we had done the background geography and the children knew how far away from London the farm is, they felt cheated!

The best alternative I could arrange was a visit to College Farm, the Express Dairy Model Farm at Finchley, where we saw the cows

come in from pasture, milking, and milk being pasteurised and bottled. However, one of the small girls was so shocked that she said: "I did not know it was like that! I shall never drink milk again."

For the next farm study we chose the one nearest to London in the Association of Agriculture series—Pickhill Farm, near Tenterden in Kent, on the road to Rye. This is a fruit and hop farm, with a smaller interest in breeding horses and bullocks in the yards in winter. I tackled teaching about this farm with several new attitudes gained from my first experience of a farm study. To begin with I went down to see the farm myself in February, so that it was a reality in my own mind.

The first time I used the Pickhill Farm folder as the basis of the study, it was with a class of eight-year-olds. I made a very large map of the farm on paper and we filled it in together. The study was a continuous interest, stimulated by set lessons, drawings, weather charts, picture collections and model-making—a wide variety of teaching and activity methods. We visited the farm at the end of June that year, and later exhibited the results of our studies on open day at the school, to the considerable interest of our visitors.

The second time I used this farm study was as a project with a top class in the school—10- to 11-year-olds. We used cyclostyled copies of the map in the Farm Study folder, which we filled in individually in preparation for a visit to the farm, noting the names of the orchards and fields and what was grown in them. We found out why sheep were in the orchards and bullocks in the yards. Together we studied farm buildings, oast houses, cottages, barns, farm equipment, the uses of electricity, the petrol engine, and cold storage. We knew the farm workers by name, and their tasks; the farmer, Mr. Day, and his family. We studied the lie of the land working from the contour lines, and observed the seaward slope. This led to a discussion of the drainage and the location of ponds.

About soil I found it difficult to teach—a London child simply calls it "dirt". I did not want to make it too difficult, yet it is the very basis of farming. I started therefore at the wrong end. I remembered when I visited the farm and was looking at the Conference pears, Mr. Day said to me, "What do you think that is at your feet?" I looked down and saw a dull grey mixture and prodded it with my foot. Though I realized that it was a fertilizer, I did not recognize it. "It's the fluff that's left over from making feather beds", he explained, "and it puts nitrogen back into the soil." This story caught the children's interest and from there we went backwards, from manures and fertilizers to what soil really is; and how the sap in the apple is not only water but takes from the soil food which must be replaced. To help us in this study I used a pamphlet issued by the School Nature Studies Association, *The Study of the Soil*, by J. M. Branson.

We went on to study climate and the farm, to see how it was shielded from prevailing winds and rainstorms, where the woods stood as windbreaks, and why Kent is called the Garden of England. The children then began studies individually and in small groups, working on subject headings such as: apples, pears, plums, cherries, gooseberries, hops and oasthouses, hoppers and their huts, woods, chestnut trees, grass, oats, bullocks, sheep and lambs, sheep dogs, horses and foals, the village of Tenterden, and farm machinery. We finished with a study of the markets for the farm produce—London and Brighton for fruit, distilleries for hops, local butchers for bullocks, sheep and lambs. In their own studies the children found themselves up against the difficulty of finding material easy enough to understand. To help them I used filmstrips on the fruit trees (Gaumont British Ltd. and Educational Productions Ltd.), one on sheep and one on trees generally, and provided them with *The Farmer's Year* (published by Evans Ltd.), several booklets published by the Young Farmers' Clubs Association, some Puffin Books and School Nature Study Association pamphlets. There were good encyclopedias in the school library and at the children's public library. But I soon came to realize that in any simple form this kind of knowledge is hard to come by and I had to give quite a lot of help in interpreting the answers to their problems.

We finished our project with an exhibition and open meeting at which the children gave their own accounts of life and work on this farm. The successful combination of all the material studied is very important. At first this uniting of themes can be done in small groups, where knowledge is often crudely but effectively stated. Later, in a formal way, it can be done before another class and teacher, or before the head teacher and visitors to the school.

It gives impetus to the completion of the project and a feeling of accomplishment if a visit to the farm can be the climax of the work. With this class I made visits to Pickhill Farm in two consecutive years. The children took the farm visit very seriously; there was no actual teaching on the farm itself, for the learning work had been done in school, and the teacher was there on the farm to learn as much as the children. The day started with the coach journey, rather a long one, down to the village, where we had picnic lunch on the green. Thereafter the children were quite ready to see what they had been learning about and they started to locate themselves (without being told to do so) on their own farm maps.

On the first visit, the children immediately asked for Moss the sheep dog and Dolly the farm horse. Children who live in blocks of flats where it is forbidden to keep dogs or cats are very animal conscious. When they learned that both Moss and Dolly had died, the sunshine of the June day seemed to dim for them. However, there were several fine horses and Larry a pet lamb to console them. The sheep were

in the apple orchard where we could see the fruit well formed on the branches. The cherry trees had already been stripped, for it was an early season in 1957. The pear orchards were especially fine and well forward. There we watched to see how two branches could be joined so that they became knit together in time, forming long rows from which the ripe pears could easily be plucked. We saw ducklings—hatched only two hours before—gaily swimming on the pond.

On the second visit, we took a different route round the farm. We looked at the many farm machines in a shed. We went into a pear orchard and, in the home paddock, saw a mare and foal which were in the care of the farmer's daughter. We watched grass-cutting in the orchard. There Mr. Day told us a great deal about Conference pears and answered the children's many questions. In the apple orchards we watched insecticide spraying and the foreman took the spray to pieces to show the children how it worked. During all this time the children delighted themselves by locating their position on their maps.

Shortly we met a man who was taking soil samples—this aroused considerable interest and many questions, and Mr. Day spoke to the children about the importance of the soil to the farmer. In the cherry orchard, after a talk on the conditions of the tree and its fruit, the children were allowed to help themselves from the trees, which they did most carefully. At the same time we saw how the bird scarer worked, and were told what precautions were taken against marauders of one kind or another. In the hop gardens Mr. Day made them do some practical arithmetic when they asked how many miles of string and how many hop poles were needed for this field. We had tried to grow two hop vines in school, but without much success.

Coming back to the farmyard we found fat lambs, penned ready for the butcher. From there we went into the huge shed, where we stood in one of the great refrigeration units, to feel the drop in temperature. The fruit foreman demonstrated the electrically driven apple grader, showed how the apples were wrapped and boxed and loaded on to a van to be taken to market by road. He explained how the size of the apple determined the number that went into a box.

Next day in school each child wrote a composition describing the visit to Pickhill Farm; and gradually completed their notebooks.

Using the same Farm Study with two age-groups, one realized in a very practical way the enormous differences in the teaching needed for 8-year-olds and 11-year-olds. With the younger children there was a striking freedom and openness of mind and tremendous enthusiasm, which demonstrated their awakening curiosity. The Association of Agriculture folder serves essentially as a guide to the teacher with the younger children; with the older classes, the information it gives can be used by the children themselves both in formal lessons and in separate study groups.

One may summarize the topics and geographical knowledge we hoped the children had gained by these farm studies. There was the factual knowledge of the geography of parts of Yorkshire and Kent, of villages like Fridaythorpe and Tenterden, towns like Driffield and Maidstone, of London and Covent Garden market. There was also the more general knowledge, with awakening ideas, about soil and water (rivers, streams and ponds) and their importance in food production; the farming practices that are the basis of food production, whether on the mixed farm or the fruit farm, and the integration that the farmer employs between the different parts of his farm—fodder crops for home-reared stock, ground used for double purposes; climate, seasons, prevailing winds, rainfall and frost; and lastly the determining factors of the geographical conditions of the farm and the farmer's personal response to those controls, no two farmers producing the same response. We hoped that in the junior school we had successfully used farm studies to lay firm foundations for good geographers in the secondary school, and that, by studying a small unit, we had introduced the children to a wide range of knowledge and ideas, based on a practical experience.

Farm Studies in a Secondary School

L. CLARK

THIS SURVEY OF FARM STUDIES in a secondary school is drawn from experience in a bilateral school in southern Scotland. It describes first the actual study material used in the courses and suggests typical sources from which farm studies may be drawn. The place of these studies in the scheme of work in geography is then considered, before an evaluation is made of this particular approach to the teaching of the subject.

FARM STUDY MATERIAL

Material for eleven different studies makes up the background to this aspect of the geography teaching in the school. Regular use is not made, however, of all the studies, as will be shown later.

Dairy farm in Cheshire, 4 miles from Nantwich. The material was collected by the author; the choice of farm depended on a fortuitous personal contact.

Dairy farm in Denmark. This study is drawn from C. F. Jones and G. G. Darkenwald, *Economic Geography*, where it appears as a sample study. It is somewhat dated.

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Corn belt farm in Illinois. This is drawn from P. W. Bryan, *Man's Adaptation of Nature*, a book which deserves attention as a source for teaching material and ideas.

Estancia in the humid pampa of the Argentine. This material is derived from *Latin America* by R. S. Platt, a pioneer in the sample study method which is amply illustrated in this book. Unfortunately, since the original field work was carried out over 20 years ago, the material is now somewhat dated. Nevertheless, for this type of farm it is still reasonably satisfactory.

Fruit and hop farm in Kent. This Association of Agriculture Farm Study is of absorbing interest for the children because it differs so greatly from the local agricultural pattern.

Grain farm on the Portage Plains, Manitoba. In this Association of Agriculture Farm Study the geography of the farm is related very clearly to its regional and national background; the study forms a useful introduction to the geography of Canada.

Dairy farm in South Auckland, New Zealand. Published by the Association of Agriculture, this study illustrates a farming activity in North Island; there is a study in the same series of a fat lamb farm in North Canterbury.

A sheep–wheat farm in New South Wales, Australia. Another Association of Agriculture Farm Study, this is the most recent addition to the series, and is very up to date.

All the studies published by the Association of Agriculture have the advantages of the series—they are comprehensive, accurate and up to date, subject, in fact, to periodic revision by the Association. The use of material that is currently valid leads children to appreciate that agriculture is not static, but is involved in the scientific revolution in which they are living.

Arable farm in the Merse (lower Tweed valley), 274 acres, between 250 and 400 feet.

Stock-rearing farm in the Tweed valley, 1200 acres, land between 400 and 900 feet—an upland but not a hill farm.

Hill sheep farm in the Cheviots, 2750 acres (70 acres cultivated), land between 700 and 2000 feet.

These three farms lie in that part of Roxburgh which might be called the "catchment area" of Kelso High School and they were surveyed in the first instance by the School's Local Studies Club. The results of the survey have been reinforced by material drawn from the Scottish survey, *Types of Farming in Scotland* (Department of Agriculture for Scotland, 1952) and unpublished statistics on a parish basis. The farms are representative of the three altitudinal zones of agricultural land use in the Tweed valley and were selected with the help of Dr. H. H. Corner of the Edinburgh and Southeast Scotland College

of Agriculture. They provide local contrasts in size, relief, soils, rainfall and climatic conditions (frost incidence, aspect) and land use.

FARM STUDIES IN THE GEOGRAPHY SYLLABUS

After a three-year course taken by all pupils, geography becomes an option. To overcome the timetable helterskelter of trying to fit an abundance of material into too little time, the concentric approach has been adopted for the first two years, except for the less able children in the first year. This method allows the satisfactory integration of local studies into the main body of the geography course.[1]

The home environment of the pupils in the school is dominated in one way or another by agriculture; therefore the first-year syllabus has been drawn up with agriculture at its core. After a preliminary course of general geography, during which the children are introduced to the local O.S. map sheets, they embark upon a study of the local arable farm. The general principles deduced from this study—e.g. the correlation between arable farms and land under 600 feet and with less than 30 inches of rain—are further emphasized by an examination of other arable areas in Scotland, especially the rich Lothian plain.

The Fens are then introduced by means of the O.S. one-inch sheet No. 124 (King's Lynn). This and the local sheet (No. 70, Jedburgh) provide a fascinating lesson on contours. A comparative study of the Canadian wheat farm is now made using the local arable farm as the yardstick by which to evaluate the Canadian counterpart.

The aim throughout is to show that whilst some general principles apply to all areas of arable farming, differences exist which are due to both environmental and historical causes. This part of the course is completed by a regional study of the Canadian Prairies, the Great Lakes and the St. Lawrence.

The second term commences with the study of the local stock-rearing farm with its Cross Aberdeen Angus cattle; this leads to northeast Scotland, the home of the renowned Aberdeen Angus. This stage is reached usually in February and the world-famous Perth sales of pedigree Aberdeen Angus and Shorthorn bulls are under way. The Border folk take a keen interest in these sales. Children bring press cuttings galore—many live on farms which are selling stock—and they are as familiar with the record prices paid for pedigree bulls as their urban cousins are with the fees paid for the transfer of professional footballers.

The Argentine was until recently the largest buyer at the sales and it is a logical step therefore to follow the stock to the southern hemisphere and to study the *estancia*. This is followed by a general survey of the Argentine and then the United States Middle West.

The second term's work concludes with a study of dairy farming which takes in the Cheshire dairy farm, followed by a regional survey

of the North Island of New Zealand, including of course the South Auckland dairy farm.

The third term's work leads from the Cheviot hill sheep farm to Australia and thence to an examination of woollen manufacturing areas in Britain and Europe.

Fruit farming provides the concluding theme in the year's work. In the absence of any local fruit farm the Kent fruit and hop farm is used, providing a lead to the study of other fruit-producing areas: Spain, South Africa and California.

In the summer term the three local farms are linked together by means of field excursions in which each is seen in its regional setting. This essentially practical method of comparative farm study is, perhaps, the most valuable part of the course. It summarizes a whole year's work. These excursions are emphatically an exercise in geographical fieldwork in which the pupils study the agricultural geography of the Borders by means of careful personal observation of the site, situation, exposure, landforms, soil and land use on the three contrasted farms. The exercise culminates in the recording of their observations in suitable cartographic form. We do not simply make three farm *visits*. From the geographer's viewpoint there is an important distinction.

Without changing the territorial coverage, the sample farm material not mentioned above is used to vary the course in different first-year syllabuses; for instance, in a year in which a local farmer sold a bull to a farm in Illinois and also visited the Corn Belt, the Corn Belt farm has been used instead of the *estancia*, though the Argentine will still be dealt with in the course. In the second and third forms, farm studies may occasionally be used in project work.

THE VALUE OF FARM STUDIES TO GEOGRAPHY

What are the advantages of the Farm Study approach to geography? It is, of course, interesting to the children, but then, in the hands of a capable teacher, so are most other methods.

In Farm Studies, as in all aspects of geography teaching, one is confronted with a vast number of facts—all of them interesting and important in their own way—and a limited amount of time. The problem of selection inevitably arises. It is almost incredible how much material can be gleaned from the study of even one farm. A glance at one of the excellent folders published by the Association of Agriculture will show this: even then the editor compiling such a folder must have omitted at least half of the original material. When I revisit our local farms in order to revise the local material, I inevitably find out something entirely new and have to enlarge my original notes.

This particular problem can be solved in the secondary modern school by the project approach, taking a few weeks to complete the

scheme. With the Junior Secondary stream* at Kelso I spend a considerable time on each farm, working in collaboration with the teacher in Rural Science. In practice this is very satisfactory, though resultant work may be called either geography or agriculture.

With the Senior Secondary stream* which makes up 60 per cent of the school the problem is rather different. The time allocation is less and the demands of examinations are much more pressing. Selection must be quite ruthless. In this case I have to concentrate on the facts of agriculture which have the greatest geographical significance.

A farm study used in a geography lesson is, of course, a sample study, sharing the advantages and weaknesses of this method. One of the major pitfalls of the sample study method is the failure to relate the sample to the region of which it forms part. We fail as geographers if we teach the geography of a farm and not the geography of a region. The second possible weakness of the farm study approach to geography is inherent in any method of teaching, and that is monotony and boredom if the same method is used without variation. Roberson and Long made this point very correctly in their appraisal of the sample study method, which was published in *Geography* three years ago.[2] They recommended that sample studies should be restricted to two in any one term. With this I wholeheartedly agree.

The chief merit I would claim for the study of actual farms is that it encourages a balanced appreciation of the determinants of land use. It provides ample evidence of the environmental influence on agriculture without the danger of naïve determinism. All of this is done in a concrete way which the children can understand.

To take some examples from our local farms: the children can see the influence of the favourable environment of the arable farm as compared with those of the upland and hill farms. But they can also appreciate that no one particular pattern of land use is inevitable. The farmer can and does grow a large barley acreage. He does not, although he could, grow large acreages of potatoes, wheat and sugar beet—many of his neighbours do so. He does not do this because of his policy of rearing pedigree cattle and Cross Suffolk lambs, with its consequent effects upon his cropping policy. Thus the element of choice is brought home to the children.

Similarly, when they study the upland farm they can readily observe from its height, its slope-gradients and rainfall, that it is not suitable for cash cropping. Yet they are told that in wartime 420 acres of wheat were once sown there. This does not in fact confuse them as it might seem to, because when the whole matter is brought down to a personal level, they can realize that the farmer *could* grow wheat but

* In English terminology, Junior Secondary approximates to secondary modern, and Senior Secondary to secondary grammar.

it would not be worth his while to do so. To attempt to explain the environmental influence using economic factors, and without this concrete example, would require a much greater maturity of thought than one would expect.

There are several essential aids and exercises to a geographical approach to farm studies some of which a teacher would have to prepare himself. They may be listed as follows:

Farm map at a scale of at least six inches to one mile, showing current land use. This should be contoured if at all possible.

Topographic maps at a smaller scale to show the farm in its regional setting. If only one scale is to be used, one inch to one mile is probably the best for this particular purpose.

Maps showing rainfall, drift geology and soils. If possible these should be at the scale one inch to one mile, and in any case not smaller than 1:625,000. Advantage should be taken of official soil survey maps where these are now available.

Cropping statistics for parishes or similar administrative units. These allow the examination of the extent to which the farm conforms to the local pattern. If an atypical farm is studied, it provides a poor introduction to the geography of the region. Comparison of the farm map with a parish map helps the children to observe the extent to which generalized distribution maps mirror or obscure reality.

Field excursions. A geographical visit to a farm should always begin or end with a view of the farm from some vantage point from which the children should be encouraged to make field sketches and prepare their own land-use maps. Where visits are not possible, photographic material should show the farm as part of the landscape as well as the details of particular crops, farm buildings, etc.

In dealing with the problem of the selection of facts much depends upon one's view of the nature of geography. I personally accept the view of geography as the science of areal differentiation and emphasize those facts which serve to distinguish one region from another and which are significantly interrelated.[3] Consequently my approach to farm studies is not on what might be called "the year's work on a farm" basis. In Britain, at least, the seasonal pattern of agricultural work is, on the whole, too uniform to distinguish between one agricultural region and another. The details of agricultural practice are of absorbing interest but their detailed study is not in my opinion a geographer's task. In any case, few geographers are adequately equipped to teach about them. We must make sure that in seeking to teach geography well we do not succeed merely in teaching elementary agriculture badly.

How then ought the geographer to approach Farm Studies in order to maintain the academic discipline of his subject? I would suggest that he should follow the precepts of two eminent geography teachers—

Professor L. Dudley Stamp, with his emphasis on the land-use map; and Professor P. W. Bryan, with his analysis of the cultural landscape.

The farm ought to be considered as a case study in land utilization—in which a very careful examination of the determinants of land use is possible, and in which the correct weighting can be given to the influence of physical, economic, historical and political factors. The farm ought also to be seen as part of the cultural landscape, as an example of man's adaptation of nature, as a synthesis of man and the land.

Despite certain problems and hazards, a few of which I have touched upon, I am certain that the Farm Study approach to the geography of agricultural regions is a worthwhile one. It is vivid and interesting. It is sound educationally since it leads from the concrete particular to the abstract generalization. It is safe geographically since it makes for a balanced view of the influence of man and nature upon the use of the land. It is an approach not only well suited for secondary modern school use, but also equally practicable in grammar schools, despite the large syllabus and restricted time, provided there is a rigorous selection of facts.

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This Changing World

EDITED BY G. J. BUTLAND

CHANGES IN THE SOUTH WALES ANTHRACITE INDUSTRY

The South Wales anthracite area has been seriously affected by the National Coal Board's recent colliery closures, which have involved four mines, resulting in the redundancy of nearly 1400 anthracite colliery workers, about 9 per cent of the area's colliery labour force. The closed collieries are the Mount, near Ammanford, the Steer, at Gwaun cae Gurwen, and the Cwmllynfell, in Cwmtwrch. At the Cefn Coed pit in the Dulais valley, work has been cut to single shift working of only one seam. All were high-cost units of production, but as a result rather of labour problems and geological conditions than of age and the exhaustion of reserves.

The actual number of redundancies were Mount 287, Steer 401, Cwmllynfell 318, and Cefn Coed 378. Most of these miners live in the Amman and Twrch valleys in and around the mining villages of Ammanford, Cwmamman, Gwaun cae Gurwen, Brynamman and Cwmtwrch. As only about 50 per cent of the workers at Cefn Coed have become redundant it is impossible to estimate which districts are most affected. Of the 750 employed there in December 1957, 21 per cent came from Crynant, 15 per cent from Skewen, and 14 per cent from Neath. The other 50 per cent were drawn from a wide area in west South Wales. The following, however, is a careful estimate of the districts affected by the three colliery closures.

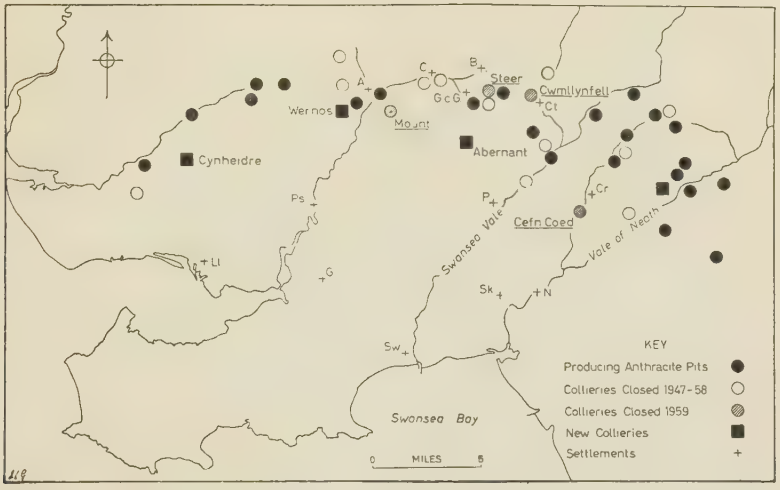
District	*Mount*	*Steer*	*Cwmllynfell*	*Total*	*Approximate percentage males employed*
Ammanford	190	10	–	200	10–15
Cwmamman	60	80	5	145	20–25
Gwaun cae Gurwen	5	145	5	155	20–25
Brynamman	5	130	40	175	35–40
Cwmtwrch/Cwmllynfell	–	30	250	280	50–55

Since 1947 the National Coal Board has pursued a two-fold policy in the anthracite area; a short-term policy of modernization of the older collieries, and a long-term policy of reopening and reorganizing selected collieries, coupled with the sinking of new pits. The aim was that production should eventually be concentrated in new and reorganized "master" collieries which would absorb the workers from the older collieries as they closed. To avoid social hardship, and to ensure a ready supply of labour for the new collieries, the old collieries were to go out of production as the new ones came in. In the meantime, to cut costs, the most uneconomic of the old collieries were to be gradually closed and their workers absorbed into the more efficient units. This policy was to be implemented with as little disturbance as possible to the life of the communities around. Much consideration was given to the distribution of the working population when

deciding the location of the future "master" collieries, and they were well spaced throughout the anthracite area.

In Cwmgors, three miles south of Gwaun cae Gurwen, a large new colliery is being developed at Abernant. It is designed to employ 2000 men who were to have come from the older collieries to the north, including 700 from Steer and Cwmllynfell, as they closed; but Abernant will not come into production until 1961 at the earliest. Should the redundant miners now leave the industry the National Coal Board will have difficulty in inducing them to return when Abernant is opened. It is conceivable that some may leave the district altogether.

The men from the Mount colliery, who live mostly in Ammanford, may be able to find some employment at the newly reopened and reorganized Wernos colliery two miles west of the village, but it is probable that only a small proportion of the 287 redundant men will find jobs there.



Key.—A, Ammanford; B, Brynamman; C, Cwmamman; Cr, Crynant; Ct, Cwmtwrch; G, Gorseinon; G.c.G, Gwaun cae Gurwen; Ll, Llanelly; N, Neath; P, Pontardawe; Ps, Pontarddulais; Sk, Skewen; Sw, Swansea.

Cefn Coed, the most modern of the existing anthracite pits (opened 1930), was recently reorganized by the National Coal Board at a cost of £350,000 to become one of the "master" collieries. Despite this large expenditure the pit has remained uneconomic, mainly because of labour problems and geological difficulties, and instead of expanding as was hoped, to absorb some workers from the older collieries in the Dulais valley, it has now been half closed. This action and the continued silence about a new pit once envisaged in Dulais valley, seem to represent a retraction from the former policy of the National Coal Board.

The prospects of the redundant miners are, therefore, bleak. The coal industry itself can absorb but few, Wernos alone of the new anthracite projects being able to offer employment to some. The remaining older collieries are full because, since nationalization, twelve other anthracite collieries have been closed and their workers absorbed into the industry. Six of these closures have been in the Ammanford–Cwmtwrch area. Other

employment in the area is limited. The post-war influx of a new industry provided jobs for almost 6000 people, 2500 of whom were women, but during 1958 there was even short-time working and some unemployment in these new industries. The possibility of obtaining work farther afield in west South Wales is limited by the serious unemployment in the coastal area, particularly around Llanelly and Gorseinon, caused by reorganization in the tinplate industry. Secondary areas of unemployment caused by the same factors, at Pontarddulais and Pontardawe, are very near the closed collieries. New industries are reluctant to come into west South Wales, especially into areas away from the Swansea district, and at Ammanford a medium-sized factory of the Wales and Monmouthshire Industrial Estates Ltd. has been vacant since 1956.

London School of Economics I. L. Griffiths

CHANGES IN THE LEA VALLEY GLASSHOUSE INDUSTRY

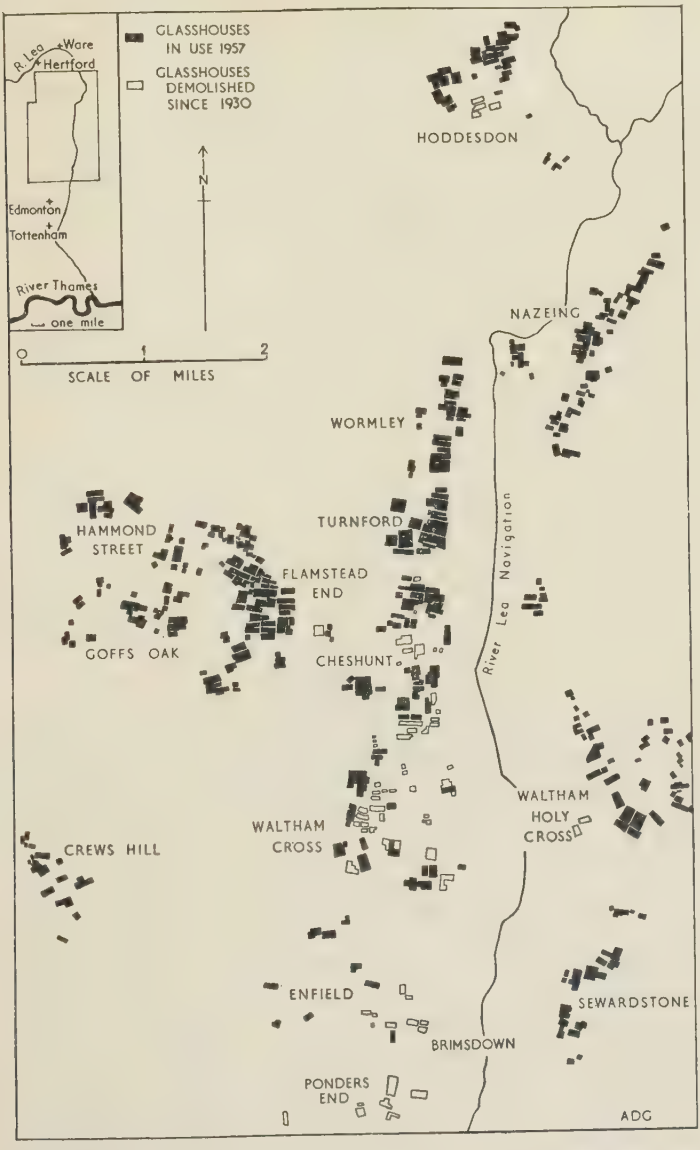
As London grew during the nineteenth century the good agricultural land in areas surrounding it was needed increasingly to supply produce for the city, and the gravel terraces west of the Lea became noted for the production of vegetables and orchard fruits. Much land west of the old north road through Enfield and Cheshunt was in use for orchards in the 1860s and 1870s, and a guide to the river Lea published in 1880 considered it to be in a "high state of cultivation producing enormous quantities of vegetables for the London market". The speciality of this area today, the production under glass of tomatoes and other fruit, vegetables, and flowers, dates from the establishment at Cheshunt in 1882 of Rochfords, a firm still of great importance; and in the following twenty years production under glass increased both there and in Tottenham, Edmonton and Enfield.

The early glasshouses were located on the Flood Plain terrace and Brickearth which extend northward from Tottenham on the west bank of the Lea for ten miles, in a belt two miles wide in the south and narrowing to one mile in the north. Available water was supplemented by private boreholes to the underground supply at the base of the chalk. The glasshouses were all within easy reach of the railway, and of the main road south to Covent Garden market.

The industry developed steadily beyond the built-up area of north London, and has characteristically moved north before the advance of the urban area. Today the southern fringe is in north Enfield and Waltham Cross and in the last thirty years there has been much demolition and closing of glasshouses farther south, particularly in Edmonton and Enfield. Small groups of post-war houses in those areas often mark the sites of old glasshouses, although a few small firms have survived, surrounded by suburban building. No glasshouses under thirty years old have been demolished, but the life span of a glasshouse in the valley appears to be approximately thirty to forty years, after which the upkeep of seriously deteriorated soil by annual soil sterilization becomes uneconomic. Moreover, smoke pollution is now affecting the Enfield–Cheshunt area as a result of increasing industrial activity in the factory groups at Ponders End and Waltham Cross, and at Brimsdown, where there are the two power stations of the Eastern Electricity Board.

Glasshouses now have to be washed five times in a season instead of twice, to remove smoke accumulations which restrict sunlight.

The industry is tending to leave the valley bottom, now recognized as an area liable to fog and also experiencing some frost pockets. It is expanding



up the valley slopes on the higher valley terrace gravels and also on to Glacial and Pebble Gravels, Boulder Clay and London Clay. Districts now involved include Crews Hill, Goff's Oak, Hammond Street, and Flamstead End west of the Lea, and Sewardstone, Waltham Holy Cross, and Nazeing east of the Lea, all areas where at present smoke pollution has little effect. There has also been development in the valley north of Hoddesdon town

centre, where conditions are still favourable. One block of glasshouses there has now been demolished for a post-war housing estate. Relatively little glasshouse building has taken place since 1945 and the industry as a whole has lost considerable acreage in the postwar years.

A problem has now arisen when glasshouses have completed their economic span, since north Enfield, Cheshunt and areas farther north come within the Green Belt ring around London and any decision to allow obsolete glasshouse property to be replaced by residential housing rests with the Minister of Housing and Local Government. In 1958 applications to make such replacements in the Urban District of Cheshunt resulted in permission for considerable housing development within the next ten years. Applications by London Boroughs for compulsory purchase of additional land now included in the acreages of the nursery industry are awaiting the Minister's decision. The land affected is understood to be becoming available within the next twenty years.

Nevertheless not only does the Lea valley glasshouse industry show no signs of a serious decline but also every intention of continuing despite the difficulties now inherent in the area. It is a closely knit industry with a comprehensive co-operative organization to aid the growers, all of whom belong to it. The Lea Valley Growers' Association, a branch of the National Farmers' Union, was formed in 1911 to advise growers. Its headquarters in Cheshunt became a Government Research station in the 1930s and although this has now moved to the Worthing area (to which some growers have been attracted by better physical conditions) it is being replaced by a new advisory station at Hoddesdon. Here research will proceed under conditions which the growers themselves experience. The new station will replace the original Growers' Association in function, existing to advise and aid the local rather than the national production.

Nursery Trades (Lea Valley) Limited, a trading association, purchases in bulk from the growers and has a packing station in Cheshunt. Lea Valley Growers' Transport Limited arranges rail transport cheaply and is particularly valuable to the small grower. Tomatoes are still the leading crop with 700 acres under heated glass today. 250 acres are used for cucumbers, and between 60 and 100 acres for carnations and roses. In 1957 1100 acres were under glass in the valley; in 1958 it is estimated that 31 fewer acres were cropped and that a further 20 acres will fall into disuse in 1959.

Tomatoes in this area are a June to July crop, the Lea valley following on the Worthing season, at its height in May and June. The need for seasonal labour and the attraction of better paid work particularly in the new local light industries make problems for owners today. The same labour problem is found also in the Worthing area and wherever both types of occupation are in juxtaposition. It seems unlikely that the Lea valley glasshouse industry will decline rapidly; it is in fact firmly established, although maintenance problems will necessarily affect the more northerly areas in future.

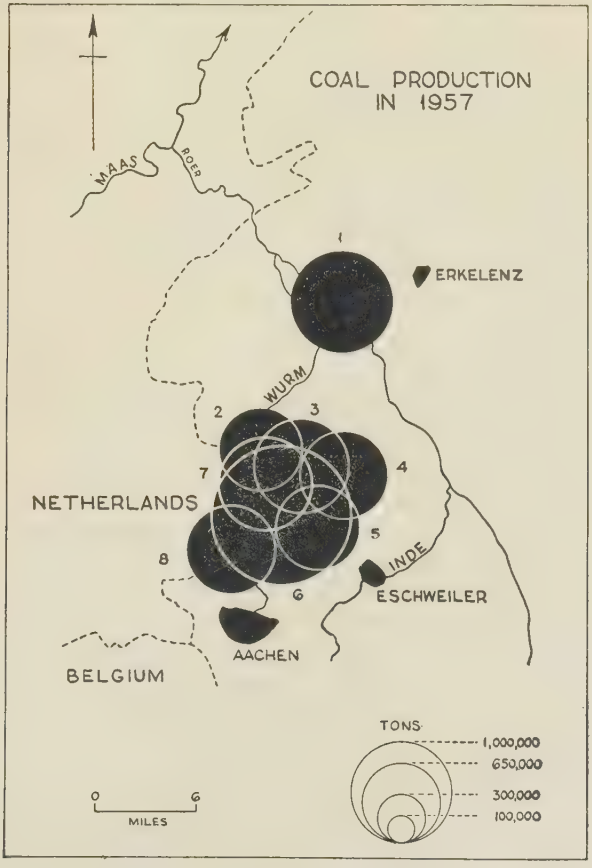
City of Coventry Training College A. D. Grady

DEVELOPMENTS IN THE AACHEN COALFIELD

The small Aachen coalfield is overshadowed by its larger and very much more productive neighbour to the northeast. With an output of 7,619,000

metric tons of coal in 1957 (little more than 6 per cent of the output of the Ruhr), the coalfield accounts for a very modest part of the deep-mined coal production of the German Federal Republic; but output continues to rise and there are plans for further expansion.

The coal-bearing rocks of the Carboniferous in the Wurm and Inde basins are largely hidden by Secondary and Tertiary rocks and a cover of sands, gravels and loess. The earliest pits were sunk in the valleys of the rivers Wurm and Inde where the seams outcrop, and from these areas mining proceeded into the deeper concealed portions of the basins. Output rose rapidly during the second half of the nineteenth century to reach more than one million tons in 1880, and 3,264,000 tons in 1913. Thereafter the peak of production was reached in 1938 with 7,753,000 tons.



Collieries in the Aachen district: 1, Sophia Jacoba; 2, Carolus Magnus; 3, Carl Alexander; 4, Emil Mayrisch; 5, Maria; 6, Anna; 7, Adolf; 8, Gouley-Laurweg.

Output fell throughout the war years, slowly at first and then rapidly during 1944 and 1945. The post-war recovery has been made possible by extensive reorganization within existing collieries and by the opening of a new colliery. At the end of 1944 mining ceased in the Inde basin, and with the exception of the workings in the outlying Sophia Jacoba concession

(situated on a horst-like structure near Erkelenz) it is now confined to the Wurm basin within a dozen miles of Aachen. The seven active collieries of this area produce anthracite, semi-anthracitic and bituminous coals of high rank. A small tonnage only (1,795,000 tons in 1957) is made into metallurgical coke locally, most of the coals being unsuitable for that purpose.

A major feature of the modernization programme has been the introduction of large mine cars and the construction of new surface installations, but in addition four collieries which were formerly worked as separate units have been amalgamated and reorganized. The individual collieries are large. Six collieries had an annual output in excess of 700,000 tons in 1957. The smallest produced 653,000 tons and the largest, the giant Anna I/II, accounted for 2 million tons. After 1924 no new colliery was opened until 1952 when the Emil Mayrisch mine, Siersdorf, came into production in a hitherto unworked sector of the Wurm basin. The colliery lies in the midst of cultivated fields in the loess country of the Jülich Börde into which both deep coal and opencast brown coal workings are advancing. Plans for the future envisage an annual output for the coalfield of 8,500,000 tons from the existing collieries. At this rate of extraction the known reserves will give a life of more than 200 years.

(The authors are indebted to the Unternehmensverband des Aachener Steinkohlenbergbaus, Aachen, for the statistics of production quoted.)

University of Hull A. Harris
University of Frankfurt W. Matzat

MILK PIPELINES AND MOUNTAIN ECONOMIES

Transhumance in mountainous regions of Europe is traditional and seems to have varied little in method and character for many centuries, despite advances in other agrarian ways of life. The recent successful introduction of milk pipelines represents a marked advance and is likely to give renewed vigour to a way of life that seems to have been declining throughout this century. As the years have passed the scope, attractions and rewards of other employments have had an increasing effect upon Alpine communities, especially drawing the young from once traditional occupations. This is now becoming reflected in the age structure of mountain communities.

The vertical transhumance characteristic of mountainous Central and Western Europe is in response to the dearth of arable land, and avails itself of the compression of vegetational zones with altitude, to integrate and sustain a valuable pastoral element in the economy. The period on the alp (usually mid-June to mid-September), although of value in utilizing the high pastures and freeing the valley of animals during the "arable" season, has certain economic and social disadvantages. The major drawback is the necessity of converting the milk yield into cheese on the alp, since the alpine communities live in semi-isolation and there is no other way of disposing of the liquid milk. Upon the autumn descent some cheese is sold, the remainder being kept for food during the winter. Cheeses no longer command good prices from buyers who have become accustomed to the standardized product of the valley *fruitière*, for they are of variable quality, sometimes small (dependent upon the size of the family herd), of variable

keeping properties and of doubtful hygienic standards. Where pastures are communal, standard and quality may be maintained by the appointment of professional cheesemakers, whose wages are relatively high.

On the social side, the attraction to the young of the more varied and remunerative employment in towns is throwing a heavier burden on the older folk, affecting the numbers available for the high pastures and leading to changes of emphasis, such as in the Haut Champsaur of the French Alps where the labour-saving fattening of lambs is increasing at the expense of the traditional rearing of dairy cows.

The problem of a better disposal of the high-pasture milk yield has long been recognized, and the introduction in Switzerland of cable transporters to deliver milk to the valley marked a big advance, but unfortunately high costs of installation and operating have precluded their wide adoption. In the valleys, *fruitières* (cheese and butter factories), usually co-operative but occasionally private, have grown steadily in importance especially during the last few decades. These factories by pooling and centralizing the milk of the commune produce standard cheeses and other dairy produce of good quality and purity, negotiate sales and marketing contracts, and utilize the by-products (in such activities as pig-rearing). These establishments have been responsible for increased prosperity among the mountain and valley communities, but it has been unfortunate that their milk intake declines sharply as the summer approaches, when most of the animals leave the valleys. Such a seasonal rhythm precludes the maximum efficiency of production and this factor has contributed to the reduced use of alpine pastures as gradually more cows have been retained in the valley during summer. It was, therefore, to the advantage of all if a means could be found of continuing to use the alpine pastures to the full but at the same time maintaining the milk supply to the valley *fruitière*.

After successful experiments in Austria in 1955 a way of satisfying these conditions is now becoming increasingly adopted in the mountainous areas of Austria, Switzerland and France. The method used is to transport the milk by pipeline. Such a solution might seem obvious, but in fact it has only now become possible with the surmounting of a wide range of difficulties varying from chemical and bacteriological to economic; and that possibility is due to the amazing properties of the plastic material polythene. It is odourless, a bad conductor of heat, light in weight, waterproof; it has a high chemical inertness, and at normal temperatures is resistant to salts and acids. It is, moreover, tough, supple, elastic and resistant to frost. These advantages are enhanced when tubes are made from polythene with 2 per cent carbon black added, rendering them insensible to ultra-violet rays, which otherwise would warm and help curdle the milk. The tubes are so robust and flexible that they can be buried easily and will resist corrosion: and so far as is known their life is virtually unlimited.

The problem posed by milk descending from a great height is that turbulence or swirl is prone to occur in the pipe. Such action causes premature separation, rendering the milk useless for cheesemaking. It has been found that this difficulty is overcome if the pipe is narrow; a diameter of about half an inch is used. Great care is also taken to see that no air bubbles break the continuity of the milk column. To keep the milk cool the pipe is buried

at a shallow depth (average 18 inches) and where this is not possible (e.g. in crossing a ravine) it is enclosed in another pipe in which fresh water can circulate. During its journey the temperature of the milk falls to about 58° F., cool enough to arrest the growth of micro-organisms. The associated problems of bacterial growth and cleanliness within the pipe are overcome by flushing the pipe with 50 litres of a bactericide detergent followed by pure water after each milk transmission. The hydrophobic character of polythene makes such an easy cleansing possible.

A drum of 500 metres of tubing weighs about 100 lbs, and it can therefore be transported easily up the mountains. The installation of the pipeline is neither difficult nor expensive. In general the shortest route is chosen, but the pipe is led round rocky outcrops or other difficult terrain. A telephone line, insulated in polythene, is buried with the pipe and portable telephones at each end allow the co-ordination of the starting and arrival operations. The operating costs of these milk pipelines are practically nil. The dispersed character of the alpine pastures suggests the small-scale nature of these schemes, for only the families and animals in the immediate vicinity of the pipe terminus can avail themselves of it. A despatch of from 50–100 gallons twice a day indicates the "traffic" of a typical pipeline. This quantity would descend a vertical distance of, say, 500 metres in about 30 minutes. As these schemes develop it is expected that each *fruitière* will be served by several pipelines.

The first milk pipeline was introduced at Stubachtal im Oberpinzgau (Austria) in 1955, where a pipe 2100 metres long brought milk down a vertical distance of 1000 metres. Others have since been installed within Salzburg, Tyrol and Vorarlberg provinces. Switzerland was quick to see the advantages of this transport system and several pipelines have been installed in Canton Valais. The longest pipeline in use so far is at St. Martin en Valais, with a total length of 7 kms. Three pipelines were tried out in the French Alps during the summer of 1957 at Nancy-sur-Cluses, Mégevette and Onnion, and their success has led to 15 others being put in hand during 1958. The word *pipelait* has become current. The system is also expected to be introduced shortly into the Cantal where similar problems are posed by the practice of transhumance.

It must not be thought that this system is applicable universally in these mountain areas. For example, it cannot be installed where the summer pastures lie many kilometres distant up the same valley; and the relative location of the nearest *fruitière* to the alpine pasture naturally has a bearing. The beneficial results of the new system are patent. It is estimated by the Swiss that the pipeline system is eight times cheaper to install and operate than that of the cable transporters. Its introduction retains and enhances the value of the alpine pastures while making smaller demands on the family. At the same time the operations of the *fruitière* can be maintained throughout the year and are more economical. A widespread introduction of milk pipelines must be expected in the next few years.

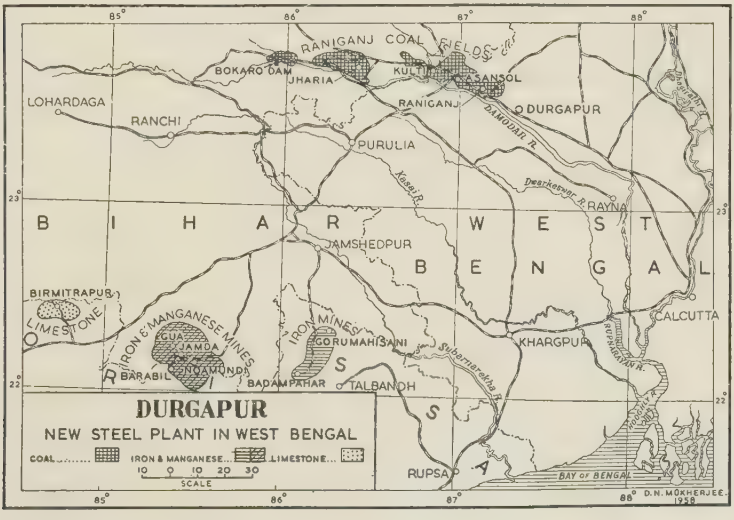
(See G. Veyret-Verner, "Quelque principes de démographie et d'économie alpine", *Rev. de Géogr. Alpine*, vol. xlvi, .1958, p. 21; and M. Bouverat, "Le pipe-line laitier ou *Pipelait*", *Rev. Forestière Française*, vol. 1, 1958, p. 33.)

Bedford College, University of London ALAN B. MOUNTJOY

DURGAPUR, WEST BENGAL'S NEW STEEL PLANT

Production of steel in India, which at present stands at about 1·5 million tons per annum (against 115 million tons produced by the United States, 55 million tons by Soviet Russia, 23 million tons by West Germany, and 21 million tons by United Kingdom) is too meagre to meet the present demand of the country. To increase India's production to about 6 million tons of steel ingots by 1961, the Government of India has decided to establish three new million-ton plants. One of these is being built at Durgapur, 98 miles northwest of Calcutta, with the assistance of a British firm, Indian Steel Works Company Ltd. Pig iron and steel are expected to be produced in 1959 and 1960 respectively.

About 98 per cent of the iron ore produced in India is concentrated in the north-eastern part of the peninsular uplands in Bihar and Orissa States, the principal districts being those of Singhbhum, Keonjhar and Mayurbhanj. Most of the ore supply in this region is high-grade haematite averaging from 60 to 70 per cent metallic iron. In contrast with the iron assets, India's supply of coking coal is very limited and is characterized by low caloric value and high ash content. All the deposits of coking coal occur in Damodar Valley basin in the States of West Bengal and Bihar, the important fields being located in Jharia, Raniganj, Giridhi and Bokaro.



Durgapur Steel Plant, using the open-hearth process, will draw iron ore from the Bihar-Orissa iron range about 150 miles to the southwest, and coking coal from the Jharia-Raniganj coalfield 45 miles to the east. The Damodar river will provide an adequate water supply, and electric power can be obtained from Bokaro and Maithon power stations.

The plant is thus almost centrally located in relation to coking coal and ore mines; it involves about 440 ton miles assembly which is fewer ton miles than the large steel centres of the United States, with the exception of Birmingham. Moreover, Durgapur is located close to the Hooghly river

industrial strip of Calcutta, where are found a large variety of steel fabricating industries including an arms factory. The transport facilities are excellent, as there will be an electrified four-track railway system, a major highway, and an all-weather navigation canal linking this production area with the port of Calcutta. Any surplus pig iron and finished steel, therefore, will have an excellent outlet through Calcutta to foreign markets.

University of Florida D. MOOKERJEE

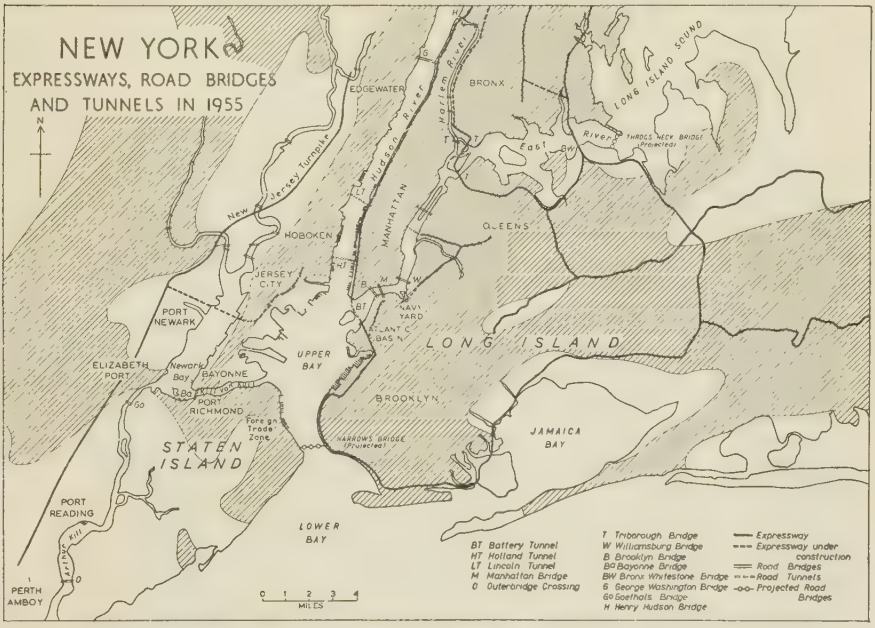
COMMUNICATIONS IN THE PORT OF NEW YORK

The Port of New York Authority, created in 1921 with the dual task of promoting commerce and developing transport facilities, took a prominent part during the inter-war period in the construction of the major bridges and tunnels to improve road access between Manhattan and the peripheral area of the port. The P.N.Y.A. and other authorities helped to tackle the increasing traffic problems of the decade before 1940 with considerable success. For example, Long Island (which by 1940 contained 40 per cent of the population of the counties bordering New York Harbour) was connected with Manhattan by five road bridges built by various authorities, the greatest achievement being the Triborough Bridge which, linking Manhattan, Bronx and Queens, has fourteen miles of road approaches. This bridge exemplified the new pattern of road crossings designed not only to cross the water but also to carry road traffic over the closely built-up banks of the waterfront area.

After a lull in road building during the second war a fresh start was made in 1945. Between 1945 and 1950 further links were made, including Battery Tunnel ($1\frac{1}{4}$ miles long) between southern Manhattan and Long Island. Valuable as these links were, however, the growth of population in the peripheral counties, as contrasted with that of Manhattan, made further developments essential; in fact the problem of intercommunication entered a new phase.

The map showing existing and projected road bridges and tunnels illustrates the new approach to the problems. Planning envisages the integration of the port area by bridges, tunnels and express-ways limited to fast traffic. In particular it aims at providing a circular express-way linking the peripheral areas of the port, for studies have shown that much traffic crosses Manhattan from one peripheral area to another merely because the existing through routes are the best. Under the new scheme the pattern of traffic flow is gradually changing from the simple radiating pattern of the pre-war years. In the new, more complex pattern, the dominant stream still radiates from Manhattan, but there is a new, increasing stream passing around the perimeter. Entry into southern Manhattan was improved by the opening of a third tube for the Lincoln Tunnel in 1957, and traffic flow is to be accelerated by the provision of express-ways, crossing southern Manhattan in an east-west direction and giving more effective links between the Hudson river and the East river crossings. As the map shows, some progress had been made in the construction of peripheral express-ways by 1955 and by 1960 major additions will have been completed, including what is probably the most spectacular development—the bridge across the Narrows, due to be finished in that year.

A large programme of reconstruction of piers and warehouses within the port has been started to meet the needs of increased shipping. New York's small tidal range ($4\frac{1}{2}$ feet) has allowed an extensive use of finger piers instead of dock basins as in the Port of London, these finger piers being of special advantage along the limited areas of level land on the lower Hudson river. In the port as a whole there are more than 200 piers, which add 235 miles (45 per cent) to the water frontage. Many of these piers, constructed in the late nineteenth century, are inadequate today, being too narrow to give convenient access for trucks, and have old warehouses which entail high insurance rates because of their lack of modern fire precautions. Reconstruction, however, demands much capital, which in a number of cases has not been available. Some of the terminals belong to railroad or shipping



Built-up areas (generalized) are indicated by hatching.

companies which have, for the most part, been able to finance renovation schemes, but a large number were built by municipalities, and projects for reconstruction have been affected by political issues. In these circumstances the work of the Port Authority has been of the greatest value, for it has, by agreement, taken over a number of terminals for reconstruction. Port Newark, for example, has been rebuilt since 1948 and made into an ocean port. Its trade increased from 811,780 long tons in 1947 to 2,570,022 long tons in 1957. In 1952, an agreement was made with the City of Hoboken to rebuild two piers and improve a third on the New Jersey side of the Hudson. The new piers are at least twice as wide as the old, and provide space for large covered sheds within which there is a loop traffic lane. The largest project, however, is that now in progress on the Brooklyn waterfront where the Port Authority has bought two miles of terminals stretching between Brooklyn Bridge and Atlantic Basin on Upper Bay.

In addition to reconstruction on the waterfront itself, improvements in road access have become necessary. The flexibility of road transport has proved a major advantage to a port which is fragmented and very much concerned with general cargo, and it is estimated that motor trucks now carry 35 to 40 per cent of the freight received and shipped. This is one of the factors increasing traffic congestion and it is hoped that the forthcoming road improvements will ensure better access to the waterfront. Another problem is the need for convenient parking space close to the piers. To meet this need the Port Authority has built the Union Motor Truck Terminal close to the Holland Tunnel; a similar terminal has been built on the New Jersey side.

Recent growth in the size of ships has necessitated improvements in the harbour also, especially in the navigable channels. During the second war less dredging was carried out than formerly and the channels deteriorated. Meanwhile because of the increase in the size of vessels the 30-foot channels in Newark Bay, Raritan Bay, Arthur Kill and Kill Van Kull became inadequate. Oil tankers had increased from a maximum loaded draught of 30 feet in 1943 to 34 feet after the war. To meet these difficulties a Federal Channel Project was initiated in 1951, and work was undertaken on all the dredged channels of the harbour. A 35-foot channel has now been completed to Port Newark, but a similar project for Arthur Kill is still unfinished and tankers using it have either to be lightened or await the tide. In East River a 40-foot channel has been dredged in the western reaches to serve the Navy Ship Yard, and east of this the channel has been deepened to 35 feet. Work has also been carried out in the lower Hudson. Along the Manhattan side, the channel used by trans-Atlantic liners has been deepened to 45 feet, and the shallower channel on the New Jersey side deepened to 30 feet as far as Edgewater where the new Seatrain terminal is located. Here a hundred loaded freight waggons can be run on to each Seatrain ship for shipment to southern ports. Unfortunately these improvements to the lower Hudson, completed by 1953, have proved very expensive to maintain, for the scouring action of the river is insufficient and constant dredging is needed.

University of Nottingham G. Joan Fuller

The Geographical Association

PROFESSOR S. W. WOOLDRIDGE, F.R.S.

Geographers are delighted to learn of the honour conferred on Professor Wooldridge, in his election to a Fellowship of the Royal Society. We congratulate Professor Wooldridge warmly on this notable distinction and take pride in it, first for the well-deserved recognition this gives his outstanding scientific contributions to our subject, and secondly for the strengthening of the status and stature of geography in the world of science which this recognition by the Royal Society assuredly brings.

APPOINTMENTS

Mr. C. A. Fisher, reader in geography in the University of Leicester, has been appointed to the Chair of Geography of the University of Sheffield in succession to Professor D. L. Linton who became Professor of Geography in the University of Birmingham in September 1958.

Dr. G. J. Butland, lecturer in geography in the University of Birmingham, and editor of "This Changing World" for *Geography*, has been appointed Professor of Geography at the University of New England, Armidale, New South Wales, Australia.

BRANCH NEWS

Efforts are being made to revive branch activities in several areas and members in these localities are urged to lend their support. The acting secretaries are:

Oxford: Mr. T. W. F. Allan, 49 Glanville Road, Oxford.

Lancaster: Mr. E. E. Jones, 9 Lowther Avenue, Torrisholme, Morecambe.

North Lancashire (Furness): Mr. A. D. Hammersley, 60 Park Drive, Barrow-in-Furness.

Inquiries have been received about forming a branch in Southampton. Any member interested in participating in this venture should write in the first instance to headquarters office offering their support.

TEMPORARY CLOSING OF THE LIBRARY

Plans for the reorganization of headquarters office and library are intended to be put into effect during the coming summer. The completion of the work in the library is expected to involve the suspension of library loan facilities and the information and reference service during July and August 1959, and members are asked to hold over general inquiries and loan requests during those months.

THE TOWN OF LECCO

Professor F. Isachsen of the University of Oslo has drawn our attention to a reference on Lecco which was the subject of Miss Coleman's article published in *Geography* in November 1958: *Lecco e il suo territorio. Studio Antropogeografico* by Professor C. della Valle. This work, published as *Mem. Soc. Geogr. Italiana*, vol. xxi, 1954, 192 pp. is a penetrating geographical study of the town in which Miss Coleman conducted the urban fieldwork described in her article.

A correction should be made on p. 224 of this article, where lake Como should be described as "the deepest lake in *southern* Europe".

SPECIAL PUBLICATIONS

Several regional studies are available as reprints from recent volumes of *Geography*; these and other pamphlets can be obtained from headquarters office:

Studies in the Geography of the South West Peninsula (2s.): contains three articles first published in *Geography* in November 1954—The Physique of the South West by S. W. Wooldridge; The Personality of the South West by A. Davies; and The Site, Situation and Functions of Exeter by A. H. Shorter.

Studies of the Vale of York (2s.): contains two articles first published in *Geography* in November 1955—The Physiography of the Vale of York by R. F. Peel and J. Palmer; and The Vale of York—the Evolution of a Landscape by M. Kirk.

The Sussex Rivers (1s. 6d.): first published in *Geography* in November 1956, is a study by D. L. Linton of the development of part of the Wealden drainage pattern.

In *Air Pollution: Geographical Factors* (4s.) by A. Garnett there is reference specially to the Sheffield region.

Copies of two educational reprints are available: *Aspects of Geography Teaching in the Grammar School* by L. S. Suggate, January 1956 (1s. 6d.) and *The Place of Geography in the Education of Boys and Girls of* 15 *to* 18 *years*, April 1957 (2s. 6d.).

All prices include postage.

TEACHING GEOGRAPHY IN JUNIOR SCHOOLS

Supplies of this new publication are now available and copies are being sent on orders already in hand. Further orders for the book are invited at once while stocks are available. The price is 3s. 6d. post free; or, for orders of 50 or more, 3s. per copy plus postage.

ORDNANCE SURVEY EXAMINATION EXTRACTS

A scheme for the loan-exchange of class sets of O.S. examination extracts between schools has been proposed by Mr. A. J. Berrey, Brighton Grammar School, Dyke Road, Hove 4, Sussex. The intention is to allow the use of a greater range of extracts in any one school. Teachers interested in this scheme should write immediately, stating the title and quantity of sets in their possession which they would be willing to exchange on loan, to Mr. Berrey who will supply details of the proposed scheme.

THE SCHOOLS' METEOROLOGICAL SCHEME

An attempt is being made to revive the Schools' Meteorological Scheme which operated between 1953 and 1956 under the guidance of Mr. E. R. Franklin and Mr. P. A. Jones. This scheme was referred to in *Geography*, vol. xxxix, July 1954, pp. 182–8.

Anyone interested in joining the scheme is asked to write (enclosing a stamped envelope) to Mr. K. Berry, Dearnside County Secondary Boys' School, Goldthorpe, nr. Rotherham, Yorkshire. Schools which participated in the earlier scheme may like to know that it is proposed to distribute information on a different basis. Mr. Berry will also be pleased to receive details of their work from schools of any kind where instrumental weather observations are made, even though such schools may not wish to take part in the exchange scheme.

COMMONWEALTH TRAVEL AWARDS AND TEACHING KIT ON AUSTRALIA

A boxed study kit for use in project work on Australia offered by Educational Productions Ltd. is a very good 5s. worth. The box contains a filmstrip and notes, half a dozen colour slides, some colourful charts and maps, wool samples, and suggestions for presentation of the material. The production of the kit coincides with the announcement of a competition for Commonwealth Travel Awards—No. I Australia, for children between 11 and 16 years—the two prizes for the winning boy and girl are 3-week conducted visits to Australia at the end of 1959. Details of the Commonwealth Travel Awards as well as the teaching kit can be obtained from Educational Productions Ltd., East Ardsley, Wakefield, Yorks. The price of the study kit includes postage.

Reviews of Books

With very rare exceptions books reviewed in this journal may be borrowed from the Library by full members and student library members of the Association.

An Archaeology of South-east Britain. A Study in Continuity. G. J. Copley. 19 × 25·5 cm. 324 pp. London: Phoenix House Ltd. 1958. 50s.

The Archaeology of Wessex. L. V. Grinsell. 14·5 × 22 cm. xv + 384 pp. London: Methuen & Co. 1958. 42s.

These are two valuable studies based on detailed local knowledge of a long series of incursions of peoples and ideas coming from the continent across the narrow seas to our southeast and overlaying one another, and of the more maritime immigrants reaching Wessex and intermingling with the southeasterners to give Salisbury Plain its wealth of sacred memories. Matthew Arnold, in his "Scholar Gipsy", pictured mariners of the second millennium coming west. We have their traces in many monuments and earthworks, and also in objects: many beads of faience and of tin; a gold-handled cup found at Rillaton in Cornwall; a Mycenaean dagger found at Pelynt, also in Cornwall, and the outline of a similar, hafted dagger incised on a great upright stone at Stonehenge; gold-mounted beads probably of Egyptian origin —all tell of long-distance intercourse about 1500 to 1350 B.C. Professor Atkinson's recent book *Stonehenge* expands what Mr. Grinsell's limited space prevents him from saying about our unique monument, one of the world's chief prehistoric relics. Why that intercourse died down we may know some day.

As regards later times Copley might have discussed possible influences of maritime westerners on the hill-top earthworks of the last two centuries before the Romans came. It would have been interesting to have Grinsell's opinion on Dr. Leed's theory that a main Anglo-Saxon advance was from the Wash southwestwards across country. On p. 67 (Grinsell) Messrs. Cunnington is a slip for Mr. and Mrs. Cunnington; the lady being probably the major partner in the work.

H. J. F.

Prehistoric Britain. Methuen's Outlines series. R. R. Sellman. 17 × 21·5 cm. 62 pp. London: Methuen & Co. 1958. 10s. 6d.

This popular introduction, backed by scientific knowledge, gives special attention to the activities of peoples and its illustrations of early folk at work are less crude than has been customary. Neanderthal man, with rough brows, sloping forehead and strong jaws is treated as a cousin rather than a forefather of ours. The great stone monuments of our west coasts, Piggott's imaginative reconstruction of The Sanctuary near Avebury and Atkinson's study of Stonehenge might have had more notice.

H. J. F.

Farming Weather. L. P. Smith. Nelson's Agriculture Series. 13·7 × 20·5 cm. ix + 208 pp. Edinburgh: Thomas Nelson & Son Ltd. 1958. 15s.

This book by the Head of the Agricultural Branch of the British Meteorological Office has been written primarily to bridge the gap between meteorological science and its practical utilization by farmers unversed in the subject. It will be read, however, with profit by the geographer, emphasizing as it does, the inter-relationship between the many qualities of the weather and climate of the British Isles and farming activities.

There are three parts to the book. The first—The Weather (84 pages)—deals with the physical processes taking place in the atmosphere, their interconnection and their presentation in the form of different values of weather elements of concern

to the farmer. An easily assimilable introduction to meteorology is the result. A healthy cautionary attitude against too facile an approach and against common misconceptions is an underlying implication of the text. Both sixth-form and university students will find here a sound starting-point for a general understanding of the weather.

The next section—The Climate (76 pages)—discusses the regional and time variations of climatic elements over the British Isles. This part geographers will find valuable in conjunction with the data presented in the *Climatological Atlas of the British Isles*. It is well supported by many maps and tables, and presents a much more realistic and complete picture than that given by reliance solely upon an unimaginative use of mean temperatures and rainfalls. Even those with a more specialized knowledge of this subject will probably learn something fresh or find familiar information expressed in a new form.

The final section—The Forecast (38 pages)—is perhaps less valuable to the geographer who should already be aware of the problems involved and be sympathetic to the difficulties of tailoring and presenting forecasts to meet the conflicting needs of the interested public.

The style is easy and clear. The book is highly recommended as an addition to a geographical library. The only general criticism is in the rather poor quality of the photographs. The author is a little unkind to geographers who are reputed to resort commonly to drawing "little lines on little maps" (p. 29) but the value of this book on applied meteorology is not one whit reduced on this score.

J. O.

Origins of Ownership: A brief history of land ownership and tenure in England from the earliest times to the modern era. D. R. Denman. 14.5 × 22 cm. 190 pp. London: George Allen and Unwin. 1958. 22s. 6d.

Bibliography of Rural Land Economy and Landownership 1900–1957. D. R. Denman, J. F. Q. Switzer and O. H. M. Sawyer. 19 × 25.5 cm. 412 pp. Dept. of Estate Management, Cambridge University. 1958. 35s.

To trace in a single small volume the historical development of English land ownership and tenure from Neolithic times up to the end of the fifteenth century is no mean task. Yet the author of *Origins of Ownership* manages to accomplish this by presenting a summary of the ideas of leading authorities, reinforcing each chapter with a select bibliography and numerous footnotes. It is essentially a statement of other people's views, and seldom does the author present and justify original ideas of his own. The emphasis throughout is on the rights and obligations associated with agricultural holdings, but consideration is also given to land specifically used for homesteads in town and country. Each chapter carries many sub-titles, which, together with the detailed index, enable one to refer quickly to a wide range of information. For example, the meanings of such technical terms as gore-acre and sulung, estovers and botes, murage and pavage, and many more, are carefully explained. The book would certainly have been improved by the inclusion of some illustrations, especially maps, but in all it provides a useful summary of the social, economic and legal background to English land ownership up to the end of the fifteenth century.

As its title indicates, the second book is essentially bibliographical in treatment and exclusively rural in scope. It forms a most useful work of reference for the geographer concerned with the agriculture and rural settlement of Britain both in their historical development and at the present day. While the centre of interest is clearly the British Isles, some important works covering the United States and western Europe are also mentioned. In that part of the bibliography covering Britain reference is made not only to the principal books, articles, reports and memoranda published between 1900 and 1957 but also to unpublished post-graduate theses in the libraries of certain

universities. The compilers have grouped their numerous entries into carefully chosen sections and subsections, adding an alphabetical list of authors together with their classified publications. The detailed subject index that concludes this valuable work enables one to refer easily and quickly to a wide range of topics including bracken eradication, coastal erosion, green belts, marling, mossland reclamation, sugar beet, tithes or even Women's Institutes, to name but a few. H. T.

The Country Craftsman. A study of some rural crafts and the rural industries organisation in England. W. M. Williams. Dartington Hall, Studies in Rural Sociology. The International Library of Sociology and Social Reconstruction. 14·5 × 22 cm. xviii + 239 pp. London: Routledge & Kegan Paul. 1958. 25s.

Rural folk are, by tradition, pessimistic but, for the craftsmen among them, not without reason, with their difficulties of recruitment and replenishment of labour, the inadequate returns for hard, skilled work and the lack of effective organization and training. The country craftsman tends to be either romanticized or viewed with economic alarm. This balanced assessment on a neglected theme steers between these perils, in an analysis of the major rural crafts, their present problems and the organizations catering for their needs. A range of typical crafts is studied in some detail, which includes the territorial distribution of the craftsmen and their service areas, mapped in Devon and the West Midlands, the latter unusually defined as Staffordshire, Shropshire and Cheshire. The firm geographical basis for the field and library investigation underlies the need for extension of this work to other counties. A summary of the regional comparison would have been helpful.

The assessment of organizations responsible for rural industries is healthily critical and points the need for greater co-ordination and authority at the centre but particularly also at county level. This is part of a wider need for constructive planning for the rural economy of the nation, with its many "depressed areas". Not all will agree with the author's underestimation of the work of Rural Community Councils, but all geographers should support his plea for extended research on the problems of the countryside. J. W. H.

An Economic Geography of the Scandinavian States and Finland. W. R. Mead. 25·5 × 19 cm. xiii + 302 pp. London: University of London Press. 1958. 42s.

This book will undoubtedly be one of the standard works on Northern Europe for some time to come and in it the author has given us the benefit of many years of close personal acquaintance with the area and of study of the literature dealing with all aspects of life within it. Whilst reflecting the author's primary interest in economic geography the book presents this branch of geography in its true perspective. The skilful interpretation of the interplay of physical, historical, human and political factors in the development of the economy of the region gives balance to the work as a whole and emphasizes that man's activities are only partly a response to economic considerations.

About a fifth of the book is devoted to the physical background and the human response to it. The effects of such aspects as relative changes of sea level, climatic amelioration and the northern winter upon life within the area make fascinating reading. Another fifth of the book is concerned mainly with the human background—including such aspects as population distribution and growth, internal migration and emigration and the results of technological change.

The bulk of the rest of the book is given over to studies of the main primary economic activities—farming, fishing, lumbering. Here the work is enlivened by detailed studies of single economic units—an analysis of a year's work on a Norwegian farm in relation to the actual weather conditions; changes in the work pattern on Finnish pioneer farms over a period of years from their establishment;

a detailed study of the Mo-i-Rana iron and steel works. The penultimate chapter deserves mention as being a most illuminating study of the Lapps.

The clarity of the author's style, 98 extremely clear maps and diagrams and 24 plates of relevant photographs make this a book which asks to be read and no library can afford to be without it.

D. R.

Homelands of Western Europe. R. W. Brooker. 13·5 × 20·5 cm. 319 pp. London: G. G. Harrap & Co. Ltd. 1958. 12s. 6d.

Written for 'O' level pupils this book gives a fairly detailed treatment of a regional character of each of the countries of Western Europe, including France, Germany, Switzerland, the Benelux and Scandinavian states. In addition to its value as an 'O' level text book it could profitably be used as a first reading by sixth-form pupils beginning a detailed study of this part of Europe.

The numerous clear and pertinent sketch maps (which supplement but do not attempt to replace an atlas), diagrams and photographs have been well chosen and are an integral part of the text. The regional studies are preceded by a study of the physical background of western Europe. In a future edition the author might consider adding a final chapter on the economic, human and political geography of the area as a whole and of its importance in the world of today.

D. R.

North-West Europe. P. J. Powrie & A. J. Mansfield. 13·5 × 20 cm. 528 pp. London: G. G. Harrap & Co. Ltd. 1959. 17s. 6d.

This book has the merits of being written in a straightforward manner, illustrated with clear and apposite sketch maps (some of which, however, lack a little polish from the point of view of draughtmanship) and giving an up-to-date account of the economic geography. It should therefore be well received by both teachers and pupils preparing for advanced level papers. The authors have had the London Syllabus especially in mind and the text embraces Scandinavia (including Finland), Benelux, Switzerland, France and Germany. Systematic studies of these are preceded by a consideration of the outstanding features of the physical geography of the area as a whole. A summing up of the political and economic geography of the area and its relationships with the rest of the world would have rounded off the study. In many ways it is a pity that the British Isles were not included for on any count northwest Europe is incompletely studied if they are excluded. The publishers are to be congratulated upon issuing the book at such a very reasonable price.

D. R.

A Geography of Italy. D. S. Walker. 14 × 22.25 cm. 256 pp. London: Methuen. 1958. 30s.

This compact survey of the geography of Italy should be a welcome addition to school library shelves. The author lays more emphasis on the historical development of the Italian regions than on the physical and biological features. The introductory section on the economic history is, however, highly compressed, while teachers with a bias towards physical geography are unlikely to find the treatment of the latter adequate. The regional descriptions which occupy the main part of the book, with the concluding chapter on the economic geography of Italy as a whole, succeed in providing within brief compass what should be a very useful introduction to present-day Italy. Photographic illustrations are on the whole good but more maps are needed.

C. J. R.

Spain. A Geographical Background. W. B. Fisher and H. Bowen-Jones. 12.5 × 19 cm. viii + 222 pp. London: Christophers. 1958. 10s. 6d.

Spain has not so far been the subject of a full-scale geographical treatise in English. With this in mind the authors seek to bring together the basic elements of Spanish geography, drawing on "a number of classical studies in Spanish and French". This short work is divided into three parts—physical basis, human background, regional geography—of which the second is particularly weak, including as it does a great deal of potted history. The periods from Roman to Arab times are covered under the title Historical Geography in one chapter; medieval and modern Spain, A.D. 700–1920, receives no more extensive treatment, being dealt with in another chapter. A good geographical approach is lacking also in a chapter devoted to language, religion, literature and contemporary Spanish life—topics which have already been dealt with in a spate of post-war guide books.

Some misleading generalizations and false interpretations of references (which are not enumerated specifically) give rise to a number of factual errors. To say, for example, that on the Meseta "the entire period 1951–54 had almost no rain at all" (p. 39) is nonsense. The failure to define the evolution of the administrative divisions of the country leads to confusion amongst the many references to "regions", "provinces" and "kingdoms". La Mancha is excluded from New Castile. Elche and Alicante are described wrongly as *Huertas* of Murcia (p. 204). The latter is of course capital of its own province and was formerly in the kingdom of Valencia. The definition of the provincial areas of Murcia and Valencia is left vague in other references.

Recent economic history is in places suspect. No more unfortunate example could be quoted when the writers say "Many [towns] as for example Sagunto have maintained more or less the same basic activities and way of life throughout the centuries" (p. 211). In fact, few towns have grown more rapidly than Sagunto since the establishment there of iron and steel works after 1917. That hydro-electricity was first installed *on a large scale* at Madrid in 1898 (p. 97) is a fact that is greatly modified by the statement on p. 176. A few inaccuracies and place-name misspellings occur. Mining at Henares (p. 87), a river valley near Madrid, presumably means at Linares in Jaen, as shown in Fig. 12; Extramadura is not an accepted spelling of that name; and Despeñaparros on Fig. 16 is properly spelt as Despeñaperros in the text.

A catalogue of errors must irritate the reader who knows Spain and disappoint the student or teacher in search of a good textbook on the country. A short textbook can either summarize from an atlas and generalize from popular works, or it can synthesize with care and first-hand knowledge. This work does not give the impression that its authors have attempted to do more than the former, and one regrets that misleading generalizations—for instance, about the dead heart of the Meseta, the surprising choice of Madrid as a capital, the importance of fishing in the shallow waters off Valencia—will continue to be handed on to others.

J. M. H.

Malaya. N. Ginsburg and C. F. Roberts. American Ethnological Society Publication. 14 × 22·3 cm. xii + 533 pp. Seattle: University of Washington Press. 1958. $6.00.

Malaya, Indonesia, Borneo, and the Philippines. A geographical, economic, and political description of Malaya, the East Indies and the Philippines. C. Robequain. Translated by E. D. Laborde. 14 × 22·3 cm. xi + 466 pp. London: Longmans, Green & Co. Ltd. 2nd edn. 1958. 42s.

The first book is described by the publishers as the result of a research project on Malayan society undertaken by a group of geographers, historians, anthropologists, sociologists, political scientists and specialists in international relations and

communications. A short chapter on the physical background is followed by sections on history, demography, settlement and communications. Other chapters deal at length with the cultures of the several racial groups, and there is a summary of the economy of the country and of political and administrative problems that hinder the emergence of a single national consciousness in Malaya. The book is a useful source of information. There are 28 maps and diagrams, and a comprehensive bibliography.

In the new edition of *Malaya, Indonesia, Borneo and the Philippines* the most important change is the extension of the Postscript by 10 pages to cover political and economic developments of the last five years. The bibliography has some new items. A good new map of Singapore (p. 138) would be better for a scale and north point. The book could do with many more maps of similar quality. The whole is a most readable and valuable account of Southeast Asia.

R. R. R.

Gambia: Land-Use Maps. Directorate of Overseas Surveys, Tolworth. Scale 1 : 25,000. 24 × 36 inches (approx.). 1958 (first sheets). Keys and sheets (3s. 6d. each) from Edward Stanford Ltd., 12–14 Long Acre, London, W.C. 2 or the Survey Department, Bathurst, Gambia.

For some years the Directorate of Overseas Surveys has been studying how to use air photography to speed the production of the land-use maps needed so urgently if there is to be sound agricultural planning in those parts of the Commonwealth for whose map production that department is responsible. It has recently issued the first of a series of thirty-five maps of the Gambia which will constitute a land-use and vegetation survey of an area of 2500 square miles at a scale of approximately 1:25,000.

There are special reasons for the selection of the Gambia for this survey. The Gambia has long depended almost wholly upon groundnuts for its national income and the concentration of its inhabitants upon cash-crop farming has resulted in serious food shortages towards the end of nearly every dry season. In recent years the Government has given much encouragement to the growing of food crops, including the cultivation of rice in the extensive swamps and marshes along the river Gambia. Though this policy appeared to be successful, rice imports have steadily increased. The Government is, therefore, comparing the acreage now devoted to rice with the area under rice in 1946, using R.A.F. photographs of 1946 (already used for the 1:50,000 D.O.S. maps of the country) and a series taken during 1956 by Aircraft Operating Co. (Aerial Surveys) Ltd. In the course of the work it was found desirable to go beyond the terms of reference, and to include information about the upland areas of cultivation as well as the details concerning rice farming.

Mr. Martin Brunt, the Land Use Officer of the Directorate, has issued with the first maps a helpful note that should be studied by all who are interested in the problems of cartography and in the prospects of better farming in the tropics. The three-colour lithographic process has been used, with a grey base for topographic and other details and a red line over-print to show the limits of the rice areas of 1946. Mr. Brunt explains how, theoretically, sixty-three different colour combinations might have been obtained; in practice only nineteen colours proved possible of which five had to be abandoned because they were not sufficiently distinguishable from others. Thus fourteen colours illustrate the fourteen categories of the maps (six for crop land, including the three for rice that show the proportion of land under that crop; three for marsh types, including reeds; two for mangrove, high and low; and one each for woodland, grassland and fallow).

The Directorate, while claiming that the maps are reasonably clear, admits that they are far from aesthetically satisfactory. Some colours cannot in fact readily be

related correctly to the key (the use of small numerals or letters as on geological maps might help here). Possibly the maps are trying to show too much and refer to combinations of crops in more detail than is absolutely necessary. They certainly fail to give the clear general impression by broad categories provided by the maps of the Land Utilisation Survey of Britain (admittedly of a less complicated land-use pattern).

The registration is by no means perfect in all the maps, but otherwise the printing is excellent. Later editions might with advantage include the international and district boundaries, at present given only on inset diagrams, since these would allow the calculations of cropping areas in particular districts.

These are, however, but minor points of criticism. For close and intensive study, the maps are excellent, supplying just that cartographic evidence and distributional pattern of land use that is usually lacking in the anthropological treatises available for certain areas in countries like the Gambia. Aerial photography and its application to land-use mapping by the Directorate are providing in some still underdeveloped parts of the world that factual basis for land planning which has all too frequently not been available for countries with a longer settlement history. The Gambia series is a real pioneer effort and its publication is a notable event in both cartography and the agricultural development of the tropics. It is, therefore, pleasing to know that the whole of this survey work (including the measurement of all the categories mapped) is being written up in detail for later publication.

R. W. S.

The Southeast in Early Maps: with an annotated check list of printed and manuscript regional and local maps of southeastern North America during the colonial period. W. P. Cumming. 22 × 28·8 cm. ix + 275 pp. Princeton, New Jersey: University Press. London: Oxford University Press. 1958. £5.

This is a most impressive study—thorough, well arranged, and finely produced. A work of reference for years to come, it is certain to be warmly welcomed by students both of the history of cartography and of the historical geography of the United States. In his introduction Professor Cumming recognizes three phases of map production: sixteenth-century compilations from reports of explorers and adventurers, evidence of the state of geographical opinion; elementary surveys executed before the middle of the eighteenth century; and, thenceforth, more ambitious and generally more successful mapping in which the gradual expansion of settlement can be observed. Written documents are occasionally used to illuminate points of detail. Appendices list the chief type maps (arranged to show major lines of influence), and maps which locate Indian settlements and trace boundaries and routes. Sixty-seven reproductions range in time and character from part of Waldseemüller's *Universalis Cosmographia* of 1507 to James Cook's *Map of the Province of South Carolina* (1773).

More than half the volume is devoted to a richly annotated list of maps drawn before 1776, an invaluable guide to anyone working on the geography of this part of colonial North America. An attempt is made to include all regional maps, and all local surveys of land south of Virginia and north of Florida (Virginia and Florida are adequately served elsewhere). Maps of the entire continent and of the Spanish, French or British possessions are generally excluded. There is a short general bibliography and, more important, a list of publications cataloguing maps of the Southeast made after 1775. The whole work is well indexed and easy to explore. To the specialist and, indeed, wherever the history of cartography is studied at university level, this monograph is worth every penny of £5.

R. A. D.

Longmans Australian Geographies. The price of these textbooks, reviewed in *Geography*, vol. xliii, November 1958, p. 286, is in Australian currency. The books can be ordered from the Melbourne house of Longmans (through a bookseller); specimen copies may be borrowed (by members) from the Geographical Association.

First Lessons in Physical Geography. G. H. C. Waters. 12 × 18·5 cm. viii + 147 pp. London: Longmans, Green & Co. Ltd. 1957. 4s. 6d.

Geographical Outlines for "Advanced" Students. H. Robinson. 12 × 18·5 cm. vii + 108 pp. London: Macdonald & Evans Ltd. 1958. 8s. 6d.

The first is a usefully priced summary for use during the first three years of grammar school courses or for any school where the geography teacher and the pupils find the "incidental" approach to physical geography tiresome and unsatisfying. There can be no denying that boys especially enjoy a set course on the physical basis even in the early years. They never wither in face of the formality of the approach, nor recognize any illogicality in the learning process because the facts are exciting enough in themselves to disarm these complaints of the "incidentalists". Mr. Waters' sympathetic introduction to his topics and his well-chosen diagrams will ensure the conversion of the doubter. Investment in one set alone would pay considerable dividends, in the field, in mapwork and in the upper school generally. There is one misleading diagram: fig. 49 should be completely redrawn to comply with the captions in consultation with an up-to-date glaciologist.

Dr. Robinson's book is a declared, unabashed "crammer" for persons undertaking examinations as tests of their further education. It will serve to remind them of what they have omitted to do; it would equally serve the teacher as an extended guide to a syllabus of physical geography. The method of presentation is very satisfactory, so much so in fact that there is a danger of the less intelligent sixth former misusing the book by accepting its conclusions, which he ought to have reached by a harder method—reading!

R. W. C.

Coastal and Submarine Morphology. André Guilcher. Translated by B. W. Sparks and Rev. R. H. W. Kneese. 14 × 22 cm. 274 pp. London: Methuen & Co. Ltd. 1958. 30s.

This important work by one well known to British geomorphologists is chiefly valuable as a summary of the existing state of knowledge in coastal physiography. A major work in this field, devoted specifically to morphology rather than to geology, was long overdue.

Little that is new is added to our understanding of perennial problems such as the classification of coastlines; the relative importance of eustatic and tectonic movements in the interpretation of high level erosion surfaces and raised beaches; the origin of the continental shelf or of submarine canyons. Yet the problems are restated with a refreshing clarity and the multitude of conflicting hypotheses are examined logically and systematically. The chapters on Coastal Evolution and the Continental Margin are particularly stimulating.

The book suffers, however, from some inequalities of treatment. For example coastal sand dunes are given little more space than ripple marks and the discussion on sand dunes is disjointed and sketchy. Solution as a coastal process is treated at great length by comparison with the space devoted to mechanical erosion and the conclusions on their relative importance seem to be equally out of balance.

Professor Guilcher's style is lucid and convincing but the very terseness of his wording results in dogmatic statements which are pitfalls for the unwary and the non-specialist. The statement (p.27) that the storm surge which caused the East Coast

floods of early 1953 coincided with high tide is inaccurate. The assertion (p. 94) that *Psamma* (*ammophila*) *arenaria* is not even slightly tolerant of salt does not accord with Salisbury (*Downs and Dunes*, 1952, p. 211) who says that it can withstand up to 2 per cent salt in the soil. The conclusion that "Stones scattered over a sandy beach have their main axes parallel to the shore", attributed to Cailleux, is much too sweeping. These and similar faults of detail appear to arise from a laudable attempt to include in this otherwise admirable survey, as much recent work as possible. This difficulty is perhaps best exemplified by the two tables on the distribution of organic oozes and red clay (p. 256) taken from Sverdrup, Johnson and Fleming. The explanatory sentences in the original are omitted with the result that only careful study reveals what was crystal clear in *The Oceans*.

The book is well illustrated with a large number of very clear diagrams and some very high quality photographs. One of its best features is the very full bibliography, though this has some surprising omissions; for example, it does not include any reference to the accounts by Professor Hans Pettersson, of the cruise (1947–8) of the Swedish oceanographical ship *Albatross*.

The translation can scarcely be faulted and the format of the English edition is of the high standard we have come to take for granted. No serious student of coastal physiography can afford to be without this most important work.

C. K.

Farm Studies and the Teaching of Geography. I. V. Young. 13·25 × 20·75 cm. 35 pp. London: Association of Agriculture in collaboration with Standing Sub-Committee in Geography, Univ. of London Institute of Education. 1959. 2s. 6d.

In the Farm Study Scheme of the Association of Agriculture, the contents of the folders for sixteen real farms in Britain and the Commonwealth are designed to cover the whole educational range from primary school to university. At the school level it is evident that the detailed nature of each folder provides an *embarras de richesse* and guidance is needed about selection and methods, particularly for the non-specialist teacher of geography. Without professing to be exhaustive Miss Young sets out to provide a series of suggestions for the use of the Farm Studies folders, applicable to various ages and abilities. The folders are not regarded as textbooks but as source books. Throughout, the emphasis is on an active approach by the children. For instance, at junior school level, a sensible use of a folder gives the children practice in several basic skills—arithmetic, reading and writing—all associated with the essential reality of an existing farm and a living farmer.

The need to link the farm with its region is emphasized, even with primary school children. This point is made more forcibly in the chapter on the secondary school, where it is suggested that the children should work from the six-inch farm map through maps at decreasing scales to attain a broad regional view by the use of quarter-inch maps. Practical methods of comparative farm study are included in this section—the very quintessence of geography.

Teachers of geography, whether or not they are specialist geographers, who have not embarked upon farm studies will derive enlightenment and stimulus from the varied teaching methods and activities suggested in the booklet. Provided the farm study ultimately leads to general conclusions about agriculture and geography and is not regarded as an end in itself, and is not allowed to monopolize the geography timetable, both teacher and taught will benefit from the introduction of ideas set down by the author. Indeed the inventive mind, if allied to acquisitiveness which would collect appropriate material, will apply some of the suggested methods to other topics.

L. C.

Geographical Articles

Listed from Periodicals received in the Library

CONTINUED FROM VOL. XLIII, PP. 224 TO 228

Journals listed here may be borrowed from the Library by members of the Association. References are listed according to the classification published in the *Annals of the Association of American Geographers*, vol. xxvii, June 1937. Authors' reprints presented to the Library are included in the list of articles.

AH—Agricultural History Review. A of G—Annals of the Association of American Geographers. A of Sc—The Advancement of Science. BAGF—Bulletin de l'Association de Géographes Français. BD—Berichte zur Deutschen Landeskunde. BE—Bulletin de la Société de Géographie d'Egypte. BG—Boletim Geografico. BHG—Bulletin de la Société des Professeurs d'Histoire et de Géographie. CG—Czasopismo Geograficzne (Czechoslovakia). EG—Economic Geography. EMG—East Midland Geographer. FO—Focus. GJ—Geographical Journal. GN—Geografiska Notiser. GNS—Geografia nelle Scuole, Italy. GR—Geographical Review. GRU—Geographische Rundschau. GS—Geographical Studies. GT—Geographisch Tijdschrift (Netherlands). IBG—Papers of the Institute of British Geographers. IGJ—Indian Geographical Journal (formerly Journal of Madras Geographical Society). JMGS—Journal of the Manchester Geographical Society. J of G—Journal of Geography. JRCS—Journal of the Royal Commonwealth Society (formerly United Empire). PG—Przeglad Geograficzny. PGA—Proceedings of the Geologists' Association. RBG—Revista Brasileira de Geografia. RGA—Revue de Géographie Alpine. RGI—Revista Geografica Italiana. RGL—Revue de Géographie de Lyon. SGA—Svensk Geografisk Årsbok. SGM—Scottish Geographical Magazine. SR—Sociological Review. SU—Survey (Univ. of Nottingham). T—Terra. TPR—Town Planning Review. WGS—Wiener Geographische Schriften. WV—Wissenschaftliche Veröffentlichungen.

(E)—English summary. (G)—German summary. *—Maps.

CULTURAL GEOGRAPHY. H. AWAD, BE, Vol. 31, '58.—L'eau et la géographie humaine dans la zone aride. B. J. L. BERRY and W. L. GARRISON, A of G, Mar. '58.—Urban rank-size relationships. B. J. L. BERRY and W. L. GARRISON, EG, Apr. '58.—Functional bases of the central place hierarchy. Y. BRAVARD, RGA, Pt. 4, '58.—L'age et le sexe des émigrés. Une methode graphique de recherche. D. de CARVALHO and T. de CASTRO, BG, July–Aug. '56.—Political geography and geopolitics (in Portuguese). P. DEFFONTAINES, RBG, Oct.–Dec. '47.—The human geography of mountains (E). M. D. DOMOSLAWSKA, PG, Pts. 1–2, '52.—Scope of urban physiography (E). M. FLESZAR, PG, Pt. 1, '58.—Research in political geography in Poland (E). P. GEORGE, BAGF, May '58.—Geographie humaine parmi les sciences humaines. B. JACOBSON, SGA, Vol. 34, '58.—Classification of the centrality of central places (E). (Bibliography.) J. KOSTROWICKI, PG, Pts. 1–2, '52.—Basic functions of towns (E). (Special reference to Poland. Large bibliography.) G. LABUDA, PG, No. 1, '53.—Subject and method of historical geography (E). (Bibliography.) S. PIETKIEWICZ, PG, Vol. 20, '46.—Remarks on boundaries and delimitation (E). (Bibliography.) J. SCHMITHUSEN, BD, Jan. '54.—Spiritual factor in the cultural landscape (in German). J. SPELT, EG, Oct. '58.—Towns and uplands: A review article. J. STASZEWSKI, PG, Vol. 23, '53.—Population of the countries of the globe from 1750 to 1950 (E). C. T. STEWART, GR, Apr. '58.—Size and spacing of cities. J. Q. STEWART and W. WARNTZ, GR, Apr. '58.—Macrogeography and social science. G. VEYRET-VERNER, RGA, Pt. 2, '58 and Pt. 1, '59.—L'indice de vitalité—application en géographie et situation démographique mondiale, 1956. G. VEYRET-VERNER, BHG, Dec. '58.—Population (Bibliography in French).

ECONOMIC GEOGRAPHY. J. W. ALEXANDER, A of G, Mar. '58.—Location of manufacturing: methods of measurement. H. J. BARNETT, EG, July '58.—Changing relation of natural resources to national security. J. M. BLAUT, EG, Jan. '59.—Microgeographic sampling: a quantitative approach to regional agricultural geography. S. DAHL, Medfoljer Geografiska Notiser, Pt. 1, '58.—World aluminium industry (in Swedish). J. DYLIK, PG, No. 4, '54.—Geomorphological problems as related to agricultural needs (E). D. W. FRYER, EG, Oct. '58.—World income and types of economies: the pattern of world economic development. M. FULTON and L. C. HOCH, EG, Jan. '59.—Transportation factors affecting locational decisions. R. GALON, PG, Nos. 1–2, '47.—Principes de l'étude des zones de gravitation économique par rapport aux rivières (F). I. P. GERASIMOV, GJ,

Dec. '58.—Geographical study of agricultural land use. R. GILDEA, J of G, Jan. '59.—Watershed management: past and present. R. GUGLIEIMO, BHG, Oct. '58.—Géographie de l'énergie (bibliography in French). C. F. HICKLING, A of Sc, Mar. '58.—Fisheries development in the colonial territories. J. N. JACKSON, SR, Dec. '58.—Social and economic forces influencing the pattern and intensity of land use. B. JACOBSON, SGA, Vol. 32, '56.—Localisation problem in a rural community (G). L. KOSINSKI, PG, No. 4, '54.—Agricultural role of the suburban zone (E). M. LE LANNOU, RGL, No. 1, '59.—Ports et la revolution des transports de mer. R. B. MCNEE, EG, Oct. '58.—Functional geography of the firm, (case study from the petroleum industry). E. NEEF, PG, Pt. 1, '58.—Economic geography and regional planning (in German). R. OLSSON, SGA, Vol. 34, '58.—Input–output analysis for the study of inter-industry and inter-regional dependence (E). M. ORTOLANI, RGI, Mar. '58.—Industrial geography (E). P. PINCHEMEL, BGH, Jan. '56.—Les industries textiles (bibliography in French). L. RANIERI, GNS, No. 5–6, '58.—Landscape and economic geography (in Italian). E. M. RAWSTRON, IBG, '58.—Three principles of industrial location. A. RENIGER, PG, No. 4, '54.—Significance of land relief for agriculture (E). S. SCHNEIDER, BD, Jan. '54.—Gas industry and its effect on the landscape (in German). P. SCHOLLER, BD, Dec. '56.—Commuting as a geographical problem (in German). R. S. THOMAN, A of G, Mar. '58.—Recent methodological contributions to German economic geography. P. VEYRET, BHG, Jan. '54.—L'élevage (bibliography in French). G. VEYRET-VERNER and C. PRECHEUR, BHG, Jan. '56.—Industries métallurgiques (bibliography in French). W. H. WALLACE, A of G, Dec. '58.—Railroad traffic densities and patterns. G. G. WEIGEND, GR, Apr. '58.—Some elements in the study of port geography. A. ZABKO-POTOPOWICZ, PG, Pt. 1, '57.—Development of geography of agriculture since World War I (E).

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